The Socio-Economic Impacts of Electric Transmission Corridors - A Comparative Analysis

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The Socio-Economic Impacts of Electric Transmission Corridors - A Comparative Analysis

Jeannette C. Boyer

Bruce Mitchell

Shirley Fenton

Mary Anne Beattie
Robert Emptage
Mark Hagan
Byron Harris

David Haynes
Mario Madau
Al Pickering
Gerold Sacher

James Tamblyn
Annette Van Boxmeer
Janette Winiecki

Department of Man-Environment Studies
Faculty of Environmental Studies
University of Waterloo
Waterloo, Ontario

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Preface

This report follows a similar paper presented in 1976, to the Royal Commission on Electrical Power Planning, entitled: The Long Term Socio-Economic Impact of an Electrical Power Transmission Corridor on the Rural Environment: Perception and Reality. This past research was undertaken by a graduate resource management class under the supervision of Professors Bruce Mitchell and George Priddle, of the Faculty of Environmental Studies at the University of Waterloo.

The undertaking of the original research was prompted by a growing concern for land use issues and management problems, as expressed through the creation of investigative government agencies such as the Porter Commission. One of the main functions of the original research project was to outline a strategy for the investigation of the social and economic impacts of transmission lines. Further, this study was to provide a case example upon which subsequent and related research could be based.

The original report was submitted in April of 1976 and in July of 1977 the Royal Commission contacted Bruce Mitchell expressing continued interest in the study. Officials at the Commission were particularly taken with the inclusion of a control group in the research methodology. The initial study indicated significantly strong negative attitudes within the control group, especially when these attitudes were compared to those of people whose property was actually traversed by the transmission lines. Further, an examination of land titles showed no significant differences between the study and control areas, with respect to property values. Comparisons such as these may indicate that the actual impact of power lines is not as great as the general public might think. It is here that the crucial investigative aspect of perception and reality is raised.

The Royal Commission suggested the undertaking of a second, larger scale study, which would encompass both a 230 KV and a 500 KV hydro line. Such a study would provide the basis to a comparison of perception and attitude formation, as well as a study of actual and perceived impact. Research of this nature would also allow for the investigation of attitude formation and elements of adaptation, with respect to individual line characteristics such as, the number of lines within a corridor, and the size, age, and voltage of each line.

Jeannette Boyer, a lecturer in the Department of Man-Environment Studies at the University of Waterloo, suggested that the study be undertaken by upper year students within the department as a means of fulfilling the requirements of the Man-Environment senior seminar course. A group of interested students were gathered and the project was underway in mid-September of 1977.

Summary

1. The purpose of the study was to examine the long-term social and economic impacts of a 500 KV and a 230 Kv transmission line. The lines studied were the 500 KV line between Essa and Kleinburg and the 230 KV line between Essa and Orangeville. The lines are of different age, voltage and physical size. An attempt was made to identify the influences of these factors on social and economic impacts. Control lines were identified one mile to the east of the existing line (Chapter 1).
2. A review of the literature dealing with the social and economic impacts of transmission lines was undertaken. The review includes a number of studies done for utility companies throughout North America (Chapter 2).
3. The physical characteristics of the lines and controls were analyzed. Comparisons were made between each line and its respective control and between the study area. No significant differences were found between the lines and their respective controls but some differences between the study areas were noted (Chapter 3).
4. A total of 1,007 sales of properties on both lines and controls during the years 1967-77 were analysed. Data from Regional Registry Offices was used to examine patterns of frequency of sales and average price per acre for different sizes and types of property. During the 1967-77 period, fewer properties of less than 10 acres and more properties of 10-50 acres were sold on the lines than on the controls. Properties over 150 acres sold with similar frequency. The 500 KV line showed an increase in sales during the period of land acquisition for the corridor right-of-way but otherwise the frequency of sales on both lines and controls fluctuated in similar patterns with the general activity of the real estate market. Properties on the lines have consistently lower average prices per acre than properties on the control. Prices were lower by 16-29% with the largest depreciating effect on small properties and a decreasing effect for larger properties (Chapter 4).
5. A total of 108 individuals on both lines and controls participated in a questionnaire survey. Participants were asked a number of factual and descriptive questions and were asked about their perceptions, attitudes and opinion regarding transmission corridors and their impacts (Chapter 5).
6. Factual and descriptive information was used to construct a community profile of the respondents (Chapter 6).

7. Information on perceptions and attitudes was analyzed and comparisons were made between each line and its control and between study areas. On-line groups appeared to be somewhat negative in their attitudes to hydro lines but showed strong evidence of adjustment. A large proportion of the controls showed an unwillingness or an inability to express opinions. Their responses tended to be ambivalent and somewhat contradictory. It is suggested that direct personal experience rather than proximity is a more important factor in the formation of perceptions and attitudes (Chapter 7).
8. There were few differences between responses from the 500 KV and 230 KV study areas. The impacts of transmission corridors do not appear to be influenced by the age, voltage and physical size of the line (Chapter 8).
9. Hydro lines appear to meet with the strongest opposition during the planning and construction phases but once in place, become neutral components of the landscape. The affected public's consciousness of their impacts tends to diminish over time. The most significant continuing impact perceived appears to be the effect of the presence of the corridor on the market value of property (Chapter 8).
10. In the past the affected public has adjusted and adapted to the impacts of hydro transmission facilities. It is suggested, however, that with the current level of public consciousness of the issues related to power generation and transmission, similar adjustment might not be expected to continue in the future (Chapter 8).

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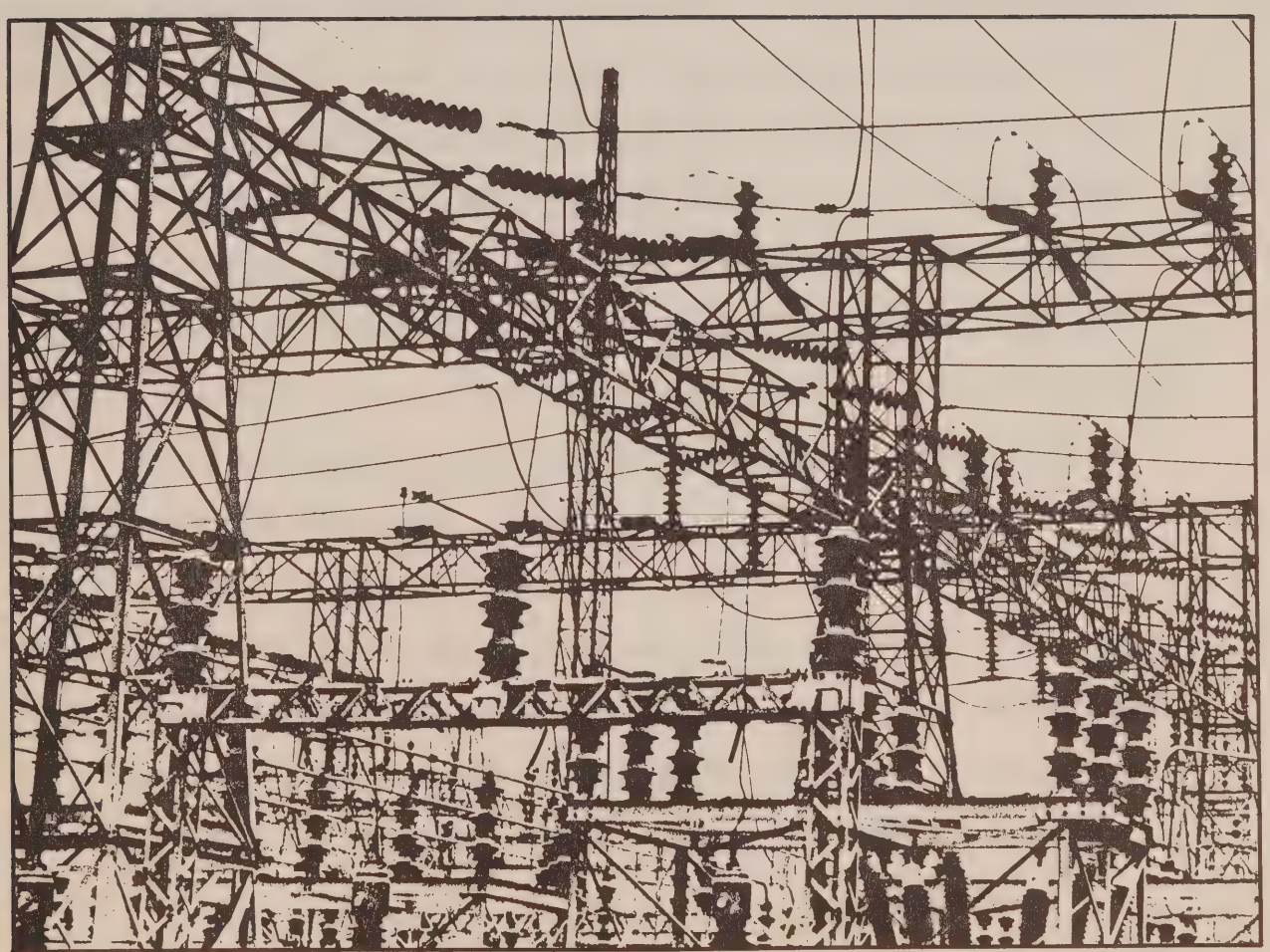


Chapter 1 Introduction

The social and economic effects of power line structures on the rural environment have been of considerable interest and concern for many years. During the last ten years this issue has become even more important, as both the number of lines and the voltage carried by these lines has increased. The recent development of 500 KV lines in Canada and 765 KV lines in the United States contributes to the seriousness of the situation.

The increase in transmission facilities is particularly significant when considering the vast amount of land being purchased for the development of new power lines. The acquisition of such land often removes or disrupts productive or potentially productive land from agricultural use. As a result, farmers and rural residents are expressing increasing concern over the effects of transmission lines on the market value of their property. At the present time, the actual effect of transmission lines on property values has not been conclusively established. Consequently property owners and hydro officials, encounter great difficulty in establishing an adequate level of compensation for land lost to hydro corridors.

Modern farming has become highly mechanized, and machinery units on many farms are very large. Operators of such machines prefer large, open fields with obstructions like trees, fences, and power lines held to a minimum. Obstacles such as these can result in loss of productive land, overlap of operations, inefficient operation of machinery, hazards to the operator or his machine, and loss of valuable time during critical farming periods. In addition, farmers in many areas face the growing

problem of multiple land use. For example, various oil and gas companies, Ontario Hydro, Bell Telephone, and the Ontario Department of Highways all require access to surface rights. Providing such access can add considerably to the inconvenience and cost of farm operations. The objections of farm operators or property owners to such obstacles on their land is understandable. Such public objection has been increasingly noted in Ontario.

Media reports would indicate that rural residents do indeed oppose power corridors, especially in the planning and construction stages. It is in these phases that the actual or potential disruption to the operation of farms and visual aspects of the landscape is most noticeable. Less attention has been directed to the attitudes of rural residents and farmers who have lived for a period of years, after construction, adjacent to a power corridor. As these corridors are relatively permanent, a study of the long as opposed to short term effects may prove to be more useful with respect to the planning of future transmission facilities. It is the purpose of this study to focus on this matter.

Study Area

This study includes an examination of the socio-economic impacts of a 500 KV and a 230 KV hydro transmission line in rural Central Southern Ontario. The section of the 500 KV line under examination is that length of line running between the Essa and Kleinburg transformer stations, a distance of 34 miles. The length of 230 KV line under study also originates at Essa, and runs south-west a distance of 35 miles to the town of Orangeville.

The 500 KV transmission facility consists of two separate but parallel lines running within the same corridor. The first of these lines was constructed in 1971, and the second line was constructed in 1973. The towers supporting these 500 KV lines are physically larger than those supporting the 230 KV line. The 230 KV line was constructed in the 1960's and is supported by a single set of towers. The differences in voltage, tower design, corridor width, and age will allow some comparisons to be drawn, regarding the influence of these factors.

To determine the impact of these transmission corridors on land value, land use, and social attitudes, two parallel routes were chosen. The power corridors included survey lots crossed by the power lines. The second, a control corridor, included lots located parallel to and approximately one mile east of the actual transmission corridors. The use of these particular study and control corridors will allow for the separation of power line impact from other influencing factors.

The study area, showing existing hydro corridors and their respective control lines is presented in Figure 1.

Goals and Objectives

The primary goal of this project was to conduct a comparative analysis of a 500 KV and a 230 KV hydro transmission line, with particular emphasis upon the social and economic impact of these facilities.

In an effort to achieve the above goal, four main areas of concern were identified:

1) In the past there has been published many reports dealing with various aspects of transmission line impact. A large number of these papers

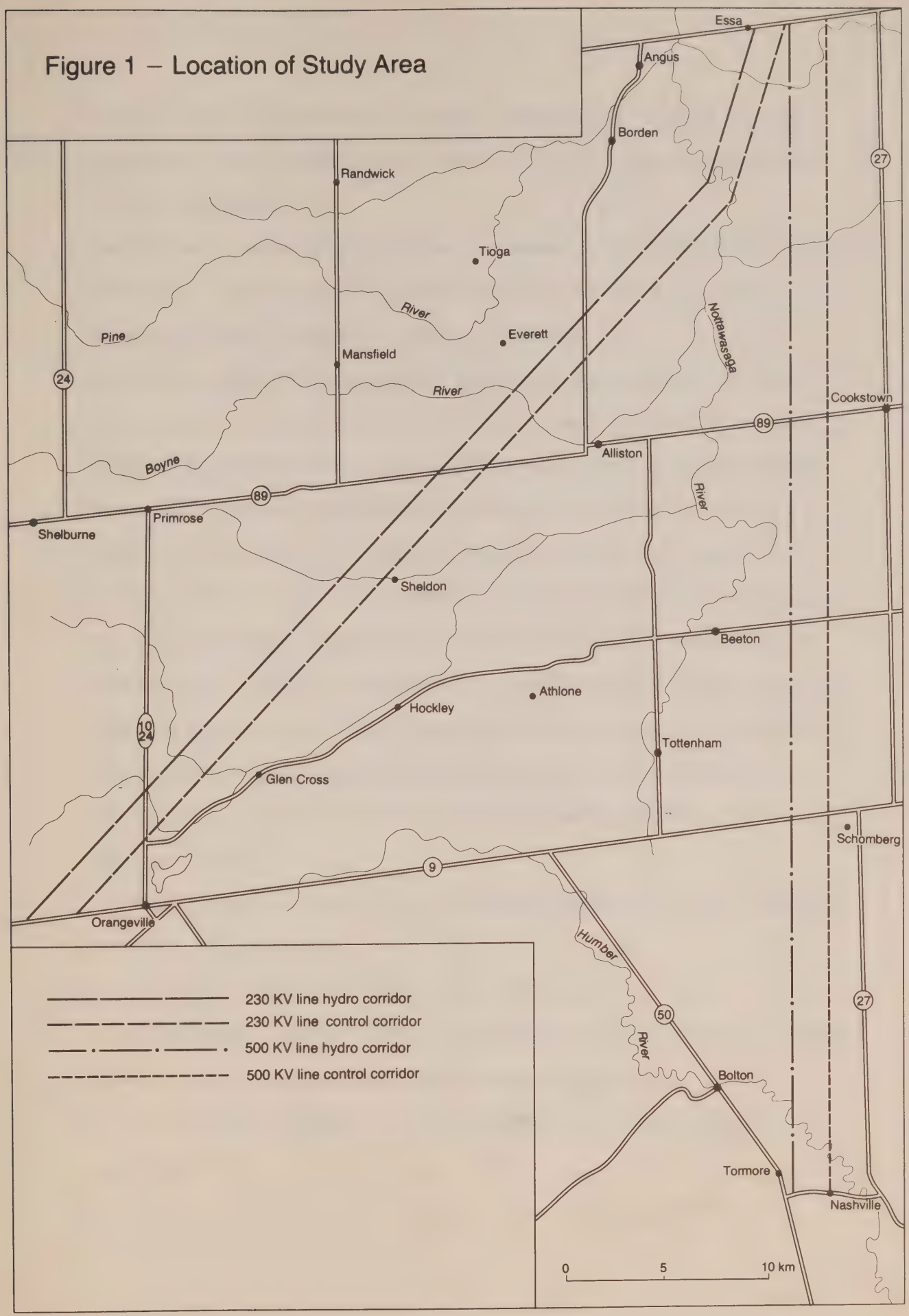


Figure 1 – Location of Study Area
Essa
Angus
Borden
Randwick
Tioga
Pine River
Everett
Mansfield
Nottawasaga River
Boyne River
Cookstown
Alliston
Primrose
Shelburne
Sheldon
Beeton
Athlone
Hockley
Tottenham
Glen Cross
Schomberg
Orangeville
Humber River
Bolton
Tormore
Nashville
230 KV line hydro corridor
230 KV line control corridor
500 KV line hydro corridor
500 KV line control corridor
0
5
10 km

are the result of independent studies conducted by various utility companies. Few of these studies have been fully comprehensive and totally conclusive.

2) The degree to which this study may be deemed conclusive will be largely governed by the physical similarity of both the 500 KV and 230 KV corridors and their respective control corridors.

3) The actual effect of transmission corridors upon the market value of rural property is a topic of much debate. Both hydro officials and property owners encounter great difficulty in putting a quantitative value on an impact traditionally viewed in a qualitative manner.

4) The process of perception and attitude formation, with regard to noxious facilities such as highways, landfill sites and hydro lines, has been identified as having two main components. The first is an environmental component, encompassing the physical characteristics of both the landscape and the noxious facility in question. The second component is behavioral in nature and accounts for influences that may result due to the proximity of the responding group to the facility under study.

With respect to the above the following objectives were identified as the basis to this study:

1) To review and summarize related literature.

2) To determine the degree of physical similarity between both the transmission lines and their respective control corridors.

3) To determine the influence of hydro lines on the market value of rural property.

4) To examine the perception and attitudes of a sample of rural residents toward the transmission lines in an environmental and behavioral context.

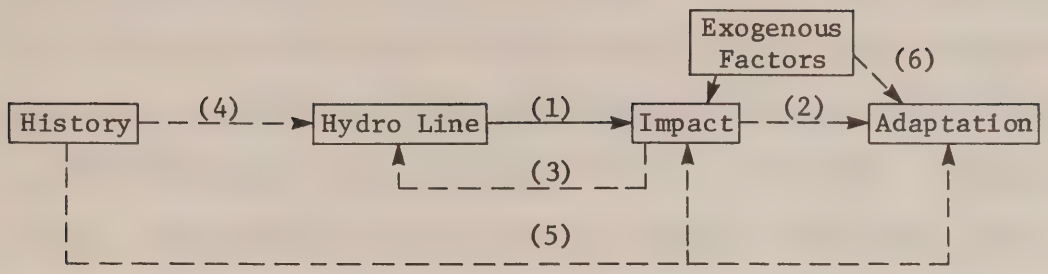
Conceptualization

In this paper the researchers have considered the problem in terms of an interactive response model. There are several advantages to such a framework. First, this conceptual model incorporates an interactive component; secondly, it provides a feedback between project and impact. Thirdly, it allows the researcher to study continuous impacts through community adaptation. Lastly, it allows for the examination of local history prior to impact.

The stimulus for this model was provided by the construction and consequent operation of the 230 KV and 500 KV transmission corridors, and the basic response to be examined is the social and economic impact of these projects on the people who live and operate within the study area. This conceptualization is however, a simplistic view. Complications arise because it can be clearly seen that the impact cannot be considered a single or point event, rather the effects linger and combine with others to form more complex situations and reactions which may surface later. As the effects of such interaction are recognized and combined with exogenous factors, the analytic problem takes on an increasingly complex character. Figure 2 graphically demonstrates a number of such complexities.

The direct impact (1) is a change in the variables which describe initial conditions, or those conditions which existed prior to the construction of the hydro line. The transition between impact and adaptation

Figure 2



Adopted from: C.P. Wolf, Social Impact Assessment (Stroudsburg, Pa.: Dowdan Hutchinson & Ross, 1974).

(2) represents both the continuing effects of the transmission corridor, and the readjustment and adaptive change of the people affected. The social responsiveness of the impacted people may result in the formation of a reaction which impinges itself upon the planning of the transmission corridor prior to and during construction. (3) This impingement may be in the form of public opposition and plan modification. Public receptiveness and subsequent adaptation at the point of impact may be regarded as a social effect of a social cause. The construction of the transmission corridor, as a prospective solution to a pre-existing concern, (namely a lack of electrical power in southern Ontario) conditions public receptiveness at the point of impact. Thus history (4) must be a consideration in our subsequent study of adaptation (5). Finally the measurement of the socio-economic effects of the transmission corridor is further complicated by the intrusion of exogenous variables, (6).

Operational Definitions

For the sake of clarity it was necessary to define precisely the following terms:

Social Impact - Concerns "people impacts", it is the effects imposed upon a community as a result of building or not building public projects, implementing public programs or formulating public policies.

Economic Impact - The effect or potential effect which a new innovation has on wages, cash flow, and general economy of the impacted area. Such impact may exist in both a positive and negative form.

Social Cost - Consist of the direct cost of resources utilized by a new innovation, together with any loss of welfare, or increase in cost, which that activity inflicts upon the economy.

Social Benefit - Are all those gains in welfare from a particular activity. They comprise the total improvement in welfare of the society as a whole including the groups undertaking the activity.

Visual Impact - Is defined as the disruption to the image of an area caused by an existing or proposed development.

Perception - With respect to this study the researchers found it more applicable to use the term in the sense of social perception. Such social perception is concerned with the impression one has of a social stimulus. Such an impression is composed of an individual's thoughts concerning the social stimulus.

Attitude - A collection of affects and cognitions which cause an individual to react in a certain manner toward the object of these feelings and beliefs.

Outline of Research

The analysis proceeded in four parts. First, an examination and analysis of related literature was undertaken. Both Ontario Hydro and The Porter Commission aided in the collection of the related literature.

The results of this examination are presented within the report under the heading of Literature Review. Secondly, the physical characteristics of the transmission corridors and the control routes were examined. This examination is based upon information provided by topographical and Canada Land Inventory capability maps. In the third phase the number and type of land sales were examined and compared. This was accomplished by the collection and analysis of transactions recorded by the Regional Registry Offices of the study area. The fourth phase concentrated on the perception of land use, land value, and visual impacts of the power corridor. A total sample of 108 respondents from both the study and control corridors were interviewed, and the responses analyzed.

Chapter 2

Literature Review

Chapter 2 Literature Review

Introduction

In the introductory chapter, one of the primary objectives of this report was identified as a review of the literature relating to the social and economic impacts of electric transmission corridors. A number of studies have been done dealing with specific aspects of the impacts. These studies have been carried out by a variety of utility companies, government agencies, universities and private consulting firms and have considered a range of types of lines and areas. Many have been in-house publications and have not been widely distributed. There have, apparently, been few attempts to draw the results of the various specific studies together into a comprehensive review of the literature on social and economic impacts. The review which follows is an attempt to fulfill the apparent need.

The literature reviewed was drawn from a number of sources. In addition to library research, an attempt was made to gather reports from utility companies in Canada and the United States who had conducted research or had contracted research to universities or private organizations. To assist on this effort, Ontario Hydro supplied a list of potentially helpful contacts. Letters were written by the Royal Commission requesting copies of any relevant material. A list of the utility companies contacted is provided in Appendix 1.

The review of literature is arranged by major subject areas. Each of the topics included has been identified as an important economic or social impact of transmission corridors. Economic impacts include the

effects on real estate values and farming efficiency and social impacts include health, safety and aesthetic aspects. The concerns identified in the literature were an important input in the design of the current research program and were of assistance in the analysis of results and the formulation of conclusions.

Property Values

The review of the literature available on the influence of transmission line rights of way on property values has been divided into three categories: residential, industrial and agricultural. This division was made since the effects of the line vary for different land uses and the reports tend to focus on one type of land use.

Suburban Residential

Suburban residential land use is not directly applicable to the current research. However, the majority of studies available deal with the effect of transmission lines on residential property values.

The most comprehensive report reviewed was conducted by the Institute of Urban Research of the University of Connecticut and was titled Transmission Line Rights of Way and Residential Values (1965). The study was aimed at determining if there is a reasonable market impact on residential property values due to the presence of tower line rights of way.

In order to study three different situations, the study was divided into three cases. The first dealt with possible effects of tower lines on developable but not yet developed acreage. The second considered the sale of land to a developer, the development of sub-divisions, sales to first owners from the builder or developer and any subsequent resales. The third

case dealt with a right of way traversing or abutting a lot on which a single family residence already existed. The report also consists of an analysis of previous studies, an analysis of sales information, a questionnaire survey of property owners, tax assessors, builder-developers, lenders, realtors and appraisers. A comparison of data was obtained through statistical analysis.

Initially, the study used two control subdivisions but it was found that additional reliability was not provided by their use. Therefore, a control was developed within each subdivision by dividing the properties according to whether they were intersected, abutted, proximate or distant in relation to the tower line. The impact of the tower line was considered not only in regard to sale prices but also with regard to lot size, length of sale time and availability of lots. Twelve hypotheses were developed for the analytical framework. These hypotheses were directed toward the view that there is a negative impact on properties due to proximity of a tower line.

Case I found too few samples to make a generalized statement about the results. However, inferences were found that there is no effect on developable acreage abutted by a tower line and that acreage intersected by a tower line caused problems in the design of a subsequent subdivision. The builder-developers felt that people buying property in this new subdivision would pay less for such property.

The results of the Case II study indicated that the intersected or abutted lots were larger than average in size and had a somewhat lower average unit land assessment. There was some evidence of a tendency to place lower-priced home models on lots closest to the right of way.

Case III found that there was little data to show a measurable negative impact on resale values. Owners continued to make improvements on their property and there was an indication of no difference in their attitudes and satisfaction in their homes.

The questionnaire study revealed that the homeowners were basically satisfied and unconcerned about the presence of the tower line. There was a minority who expressed negative reactions, distrust and an unwillingness to repeat the experience. The tax assessors showed a division of opinion but agreed that acreage was unaffected. The views of builder-developers and lenders were fairly consistent. Some lenders were reluctant to finance a subdivision affected by a tower line and builders felt that the line affected the capability of a parcel of land to support the maximum number of residential lots. The realtors and appraisers expressed negative opinions regarding the marketability of acreage and developed properties affected by a tower line.

The report concluded that true value of most residential properties is not affected by the presence of a tower line and that any negative impact is revealed by the fact that encumbered and abutted lots were usually larger in size but sold for the same price as lots in the rest of the subdivision. The twelve hypotheses were either disproved or not proven.

A number of studies were done by Thorne Appraisal Service Inc. in the State of New York (Thorne Appraisal Service, undated). The studies focussed on residential property values in subdivisions and were conducted in a similar manner. The size of the transmission lines involved in the studies was not always specified. One study dealt with two parallel lines,

one of 69 KV and the other of 115 KV and another involved a line with wooden poles.

Conclusions were based on property sales from developer or builder to first owners. Thorne Appraisals obtained the sale price of each property in each of the subdivisions studied and divided the properties into categories based on house design and date of sale. Within these categories, values of properties abutting and away from the line were compared. The mean and median selling prices of like properties adjacent to and away from the right of way was found. In each study it was concluded that the lines had no effect on the value of residential properties.

In all of these studies Thorne Appraisals felt the fact that all the homes were alike in age, construction and size and would have the same access to facilities enabled them to state that these factors would not have an effect on the property values.

Thorne Appraisals also studied vacant residential lot sales in the report, Effects of Transmission Lines and the Right of Way upon Residential Site Values in the Vicinity of Stoney Point. The fair market value of the lots adjacent to and away from the right of way were compared. Topography, slope, services available, zoning and degree of encumbrance were considered. The study concluded that the values of the lots were not adversely affected by the transmission line.

Two reports on residential property were received from the Consumers Power Company of Jackson, Michigan. Charles W. Layton of the Detroit Edison Company compared sales of homes in a subdivision traversed by a 120 KV line. In his report, Subdivisions Values Unaffected by Tower Line, Layton concluded

that property values are not affected and that homes adjacent to the right of way sold just as quickly as those farther away. The method of comparison was not specified but interviews were conducted with the purchasers of property adjacent to the line. The report states that these people were not concerned about the presence of the line and they felt that the extra land was preferable.

Two studies conducted by R.D. Grant and Sons were reviewed. One study, The Effects of a Tower Line Right of Way and/or Substation on Residential Values was done in California. The purpose of this study was to determine the opinions of home owners and people involved in real estate transactions as to whether a tower line and/or substation had any effect on property values. Questionnaires were sent to home owners in two subdivisions encumbered by transmission lines. One subdivision contained a 70 KV line and substation. Questionnaires were also sent to assessors, real estate brokers, real estate appraisers and lending institutions involved in real estate. The study found that the professional real estate people felt that the line would negatively affect property values. Their reasons were that the line is unsightly and would affect their personal decision to buy. According to the maps provided with the study, only twenty-five properties of home owners abut the line, yet 200 questionnaires were administered. The study concluded that the effects of the line and substation are overlooked if the homes are of good quality.

A study of the Effect of Transmission Line Easements on Real Property Values was also done by R.D. Grant and Sons in British Columbia in 1974. The purpose of this study was to "keep abreast of changes in the

possible effects that transmission line easements might have on subdivision lots which they encumber, those lots which face the lines, and effects on raw, undeveloped acreage..." (p. 1). The report studied the prices of land, selling time, assessed value and the value of the improvements in eight areas. Comparisons were made within the subdivisions between encumbered lots, lots facing the line and unaffected lots. Graphs were drawn in order to compare the average values and although no general conclusions were stated, a visual comparison of the graphs seems to show little difference in values.

A report by K.H. Lashley entitled, Influence of Deep Cove Substation on Adjacent Residential Subdivision looked at a substation and a right of way in 1972 in Vancouver, B.C. The study found that there was no influence on prices due to the substation and right of way but there was some buyer resistance. The resistance, however, was not sufficient to reduce the prices of the lots adjacent to the right of way and substation. It was stated elsewhere in the report that the substation was of low profile design and that it is the policy of the district of North Vancouver to market only a limited number of lots at one time to keep prices up.

Another substation study, also in Vancouver, was done by G. Thomas called, A Report on Camosun Substation's Influence on King Edward Place Subdivision, Vancouver, B.C. (1972). This was also a low profile substation. The residents in this community complained of the hum coming from the substation. In this case, the assessments of the lots adjoining the substation were reduced and the lots required a longer exposure to the market. It

was felt by Thomas that the hum and unsightliness of the substation led to poor acceptance of the adjacent lots. This subdivision had poor public transit and the homes were prestigious, appealing to a select market. In conclusion, Thomas felt the substation did influence the value of lots adjacent to it, but the amenities and disadvantages of the subdivision must also be considered.

An article was published in the November, 1975 issue of Electric Light and Power summarizing the work of Robert G. Strong, the Director of Economic Research for Herbert H. Smile Associates Inc. The title, "Property Values Don't go Down when Transmission Lines Go Up" summarizes the findings of Strong.

Strong researched property values for eight years in New Jersey and Maryland. Forty-five case studies were performed including a range of types of developments and property values. The study focussed on effects of transmission lines on property values and development potential of adjacent land based on Strong's belief that, "if any substantial portion of the population found them (tower lines) unattractive or otherwise objectionable, this would certainly be reflected in property values" (p. 41). His studies considered original sale price data, resale values, investigations of the ease of original sale by developer and frequency of sales. Homes adjacent to, and removed from the right of way were compared. Strong concluded that "a transmission line, in and of itself, has no general effect on property values, either adverse or favourable" (p. 43). He also notes that this may change if public opinion changes.

Industrial

One study was reviewed dealing with the effect of transmission lines on industrial property, Economic Study of Industrial Land Values in Woodard Industrial Park, Town of Clay by Thorne Appraisal Service Inc. Its purpose was to determine if the transmission line had any effect upon adjacent industrial land values.

Sale data was obtained for industrial properties in the area from 1955 to 1967. These prices were analysed, the properties were examined and buyers and sellers were interviewed. It was concluded that there was no reduction in industrial land values for those properties adjacent to or encumbered by transmission line rights of way.

Estate Residential

The R.A. Cooch Company of Ann Arbor, Michigan, conducted a study in 1968 considering improved rural residential, vacant acreage and vacant properties. Cooch compared the sales of the properties adjoining tower lines and those away from the lines. Twenty-six sales of properties with acreage were studied, six of which abutted the line and twenty did not. Date of sale, size, location, frontage, trees and road types were considered. The size of the lines involved in this study was not stated. The study found that there was no difference in values between properties that abutted and those that were away from the right of way. These properties had rural residential development as their highest and best use. Cooch states that there is a market for the properties that are adjacent to rights of way and that the prices paid for these properties are not measureably different than the prices paid for the properties which do not abut tower lines.

In 1974, the Realty Research Group conducted a study for Ontario Hydro on the Impact of Hydro Transmission Lines on Estate Residential Property Values in King and Vauhgn Townships and the Regional Municipality of York. Estate residential properties were more clearly defined as those between one and fifty acres in size, located in agricultural areas and whose use is predominantly residential. Conclusions were reached by comparing properties crossed by, in sight of and out of sight of hydro lines.

The market data approach to analysis was used involving the collection and comparison of data on similar properties sold within a given time frame. The differences in properties were accounted for by calculating the replacement cost of all improvements, followed by deductions for physical and functional obsolescence. The average sale price per acre was then calculated for all three groups, making adjustments for the dates of sale to correspond with other groups.

The results indicated that, "Hydro transmission lines have no impact on the market value of the estate residential properties studied when they are located in sight of the Hydro line". They also determined that, "with regard to properties crossed by the Hydro line, the line has no impact on properties under 10 acres in size, however, Hydro lines which cross the larger estate residential properties studied, 10 acres and over, depress their market value between 10 and 20 percent" (from introductory letter, M.S. Cane, Senior Appraisor). Also discovered, was that the average sale price for property in sight of the line was higher than that for property out of sight of the line.

Agricultural

The studies on the impact of Hydro transmission lines on agricultural land values reviewed, arrive at similar conclusions.

An analysis of sales and prices obtained for properties with and without rights of way was made by Stewart, Young and Mason Ltd. for Ontario Hydro in June of 1977. This study, Transmission Line Studies, Bruce and Huron Counties, consisted of a lot by lot comparison of the 270 properties sold. No general conclusions were made in this report, however, it was found that one farm crossed by the hydro line actually sold for the highest price paid that year for agricultural property in the township.

A more detailed analysis of transmission line effects on agricultural property values was carried out in 1974 by the Realty Research Group. Their report, Impact of Hydro Transmission Lines on Agricultural Property Values defined agricultural properties as those properties greater than 25 acres in size, located in rural townships and used primarily for agricultural production.

Again, a sales analysis approach was used, and the data was collected on properties crossed by, in sight of, and out of sight of the line. Varying property characteristics were also considered in the report and the impact that such variables as farm type, acreage, soil quality, farm building value, and number of towers have on the market value were quantified. By statistically analysing all the sale properties in each area, comparing sale price and property characteristics, a formula was produced that enabled a value to be assigned to each characteristic. This

value then formed part of the total amount of the property sale price. As the proximity to the Hydro right of way was included as one of the property characteristics examined, a value was also determined for it. The conclusions state that this value, in comparison to the others, was insignificant in its effect on sale price of farm properties and therefore, the Hydro line has no effect on the market value of properties at any proximity. Any difference in sale prices encountered was attributed to "injurious affection" (p. 4), that is, the "damaging effect caused by land acquisition and the construction and use of a public work".

In a paper presented by Professor J.A. Brown, Dean of Agriculture, University of Saskatchewan, to the National Conference of the Appraisal Institute of Canada in 1975, a literature review concluded that no evidence of property value decreases due to proximity to a hydro line has been determined or proven. Citing the results of a committee investigation chaired by I.C. Robinson, (University of Saskatchewan, 1960) it was concluded that "there is some adverse effect or 'depreciation' to a farm by reason of the existance of a power line, but that this is not synonomous with an adverse effect on the 'market value' of a farm, since the facts of the market tend not to support this" (Brown, 1975, p. 5).

The analysis approach in Brown's report used the sales data for the years 1965-70 in south-east Saskatchewan. These prices were all converted to a 1970 base using the average value of farmland by crop districts determined by the Saskatchewan Department of Agriculture. A least squares program in a multiple regression analysis was used to quantify certain

relationships and determine their statistical significance. Two general conclusions from this analysis were stated:

1. The market data approach or attempts to measure adverse effects of power lines through their impact on land values of parcels of 1 or 2 quarter sections do not provide an adequate basis for arriving at a fair and reasonable compensation to property owners affected by power lines.
2. To estimate the impact of a power line on a parcel of land and the farming of it, there is a need to have an analytical approach which will clearly take into account the extent of ownership rights taken away and the economic impact on the operations of the land (Brown, 1975, pp. 11-12).

It was determined, then, that hydro transmission lines, "do not have a big enough adverse effect on entire parcels of land to be reflected in the selling prices of such parcels" (Brown, 1975, p. 18).

The conclusions stated by the report submitted to the Royal Commission on Electric Power Planning in 1976, by members of the Faculty of Environmental Studies, University of Waterloo, also found no effect of transmission lines on agricultural property values. This report, The Long-Term Socio-Economic Impact of an Electrical Power Transmission Corridor on the Rural Environment: Perception and Reality, used a Chi-square analysis to determine if any difference existed between the type of land purchasers on the hydro corridor to those on a control corridor. Chi-Squared and Kolmogorov-Smirnov tests were employed to determine differences in selling prices between the two corridors and the conclusions indicated

"that there is no significant difference in the types of land transfers and in sale price per acre in the study area" (Mitchell, Priddle, et al., 1976, p. 29).

Summary

The findings of the majority of the residential, industrial and agricultural studies indicate that there is no effect on property values because of the presence of a hydro transmission line. The exceptions make it clear that any detrimental effects are of minor significance in relation to other property characteristics.

There are many variables to be considered when assessing a property, some reports take these into account while others ignore or reduce their significance. Examples of property characteristics to be considered include: location, soil type, date of sale, farm type, building values, soil quality, capability for agriculture, proximity to other rights of way, road types, bargaining ability of buyers and sellers, demand for property, economic, social and political conditions, and proximity to urban areas and to facilities. Taking these into account, the general conclusion of the reports reviewed regards the impact of hydro lines as insignificant by comparison.

Farm Efficiency

This section considers in general terms, the effect of transmission corridors on farm operation and efficiency after lines are in place. Land loss, time loss and damaged crop costs will be examined.

In the study, Impact of Hydro Transmission Lines on Agricultural Property Values, twenty-six farmers in King and Vaughn Townships were

questioned about the effects on their land. The land area lost to production per tower included the area under the tower base plus an area surrounding the base. The general opinion of the farmers interviewed was that a steel tower caused an overall loss of twice the area of the tower base. It was also concluded that the towers were a nuisance and a possible hazard to farm equipment.

Tower design and placement were considered to be important factors. A single guy line from a pole located along the edge of a boundary or road, jutting back into a field caused almost as much loss in productive land as a steel tower. This is the case because farm machinery has to take a wide sweep around the base of the tower to give sufficient clearance to the guy wire which is sometimes difficult to see. The farmers suggested the following:

a) square based towers should be placed "corner on" so that farm machinery will have to make two turns instead of three when working around them;

b) wherever possible, towers should straddle fence lines; and

c) "V" frames with long guy lines should not be used because the guy wires are difficult to see.

Professor J.A. Brown identified increased operating costs due to transmission towers in, "The Effect of Power Line Structures and Economics on Farm Land Values". In the majority of cases, farm operators worked around the structures when they came to them rather than adjust their field patterns to coincide with the easements and power lines. If the farmers did change their field patterns it could lead to additional centre

furrows, corner furrows and problems with edges of fields.

The Environmental Resources Section of Ontario Hydro's Department of Forestry in their study, The Effects of Hydro Transmission Towers on Farm Operations in Western and Eastern Ontario: A Synthesis of the Ridgetown and Kemptville Studies, identified many aspects of transmission line effects on efficiency and production. For example, towers straddling fencerows had the least amount of non-cropped land associated with them and the least amount of time lost in work. Towers within the field had the greatest amount of non-cropped land and a greater amount of time lost in work. Time loss due to the towers varied greatly due to equipment size and type - smaller equipment could pass between the tower legs resulting in less loss of time, inaccuracies in observations, or the variable experience of the equipment operator.

The following is a closer examination of land loss, time loss, costs of damaged crops, equipment damage potential, weed control and multiple corridors. Suggestions for possible future action will end this section.

Land Loss

Tower size is the most direct factor which affects loss of land (land which cannot be cultivated). As the tower size increases, so does the land loss from crop production. A diagonal tower of certain dimension usually has greater land loss than a square tower of the same dimension. Also, poor maneuverability of vehicles because of tower design and size increases the amount of land loss. The cost of the non-productive land seems to be responsible for the greatest percentage of overall costs of hydro towers to farmers.

Time Loss

Time loss varies for each operation type and tower size. It generally increases with tower size depending on the number of interrupted passes of equipment. It also depends on whether or not the particular equipment can pass beneath the tower. Orientation of the towers also has an effect on time loss. Square towers parallel to the work direction causes less time lost, in most cases, than towers orientated diagonally to the direction of work.

Crop Damage

Damage to crops usually takes the forms of soil compaction around the tower base, herbicide build-up and weed encroachment outward from the tower base. During normal cropping operations, materials such as fertilizer are applied. Some of this material is lost when applied under and around tower bases, but this is thought to be minimal. As a part of the overall costs of hydro towers, material loss costs are quite insignificant, even though farmers' experiences showed that crops under and closely around the base do not usually grow to maturity.

Equipment

It has been found that larger equipment would not be affected to any greater degree by hydro towers than smaller equipment, although mechanical differences could cause variations. Many operations can be performed under towers, depending on equipment size. However, since a crop often cannot be harvested, there is little, if any, value to working under the towers.

Control of Weeds

In general, tillage will control growth of weeds if smaller equipment and larger towers are the case but this is impossible with large equipment. Persistent herbicides can be sprayed to eliminate weed growth for one or two years. To prevent spray drift, which can destroy adjacent crops, spraying is usually done under low pressure early in the morning or just before rain.

Multiple Corridors

There are many cases where more than one transmission line will occupy a corridor. The difficulties of maneuvering equipment around individual towers would surely beg the question of whether or not the associated psychological stress would multiply as the number of towers increase. There is definitely a need to study the psychological effects of transmission towers on the farm operators.

Suggestions

The following are suggestions which could reduce crop loss and damage and increase farm efficiency.

1. If towers must be placed in the middle of fields, they should be orientated in the direction of work.
2. Bisecting of farms should be avoided.
3. To minimize the impact on farm operations, towers should be placed on the fencerows, wherever possible.
4. If there were any way to reduce the percentage of non-productive areas due to the presence of towers, the effects on farm income could be reduced.

5. Studies which examine the psychological effects of towers on machine operators should be initiated.

Health and Safety Aspects

Electramagnetic Fields

Due to growing concern, many studies have been conducted with regard to the biological effects of exposure to electromagnetic fields. The results of these studies fall into two general categories: the Russian studies which claim to show the existence of deleterious effects and the North American studies which claim that effects do not exist or are too small to be significant. As well as being numerous, the studies are also varied. They include investigations in the areas of growth and development in plants and animals, cell damage, genetic alterations and physical and behavioral changes in humans. Perhaps the best source of information on this topic is the EPRI report, Bibliography on Biological Effects of Electric Fields.

Information originating from within the Soviet Union indicates a number of unpleasant effects suffered by switchyard workers who had been exposed to high voltage levels for a long period of time. Lack of appetite, lethargy and loss of sexual drive were attributed to this exposure. The only equivalent report came from Spain where five of eight workers in a new 500 KV power station complained of headaches, diminished appetite and tiredness. In the Russian case, two studies are usually cited to substantiate their claims. One study, by Asanova and Rakov (1966), gave the results of medical examinations performed on 45 workers in 400 KV-500 KV substations. Most of the workers reported headaches, lethargy and appetite

loss in addition to a small number of other ailments. However, little substantive evidence was offered to relate these effects to exposure to electromagnetic fields. Also, there was no use of a control group, so it is not known if the results of this study are simply indicative of general population characteristics. The other study, by Sazanova (1969) made use of two groups of workers, one of which was exposed to electromagnetic fields for a shorter period of time during the work day. The results indicated that those workers exposed for a longer period of time exhibited greater fatigue. Again, the results were not well correlated with exposure to electromagnetic fields since the study did not indicate whether age, physical condition, and occupational activity differences were controlled. More recent animal research in the Soviet Union shows a range of responses related to electromagnetic field exposure. Again, however, details of the results of these studies are not given in the reports, so it is not possible to judge the findings.

Contrasting the Soviet claims are the studies conducted in the United States. Johns Hopkins University (1973), in a nine year study of linemen exposed to high voltage electromagnetic fields, could find no adverse effects in any of the areas tested that could be attributed to the exposure. Perhaps the most comprehensive research on biological effects of power lines is currently being conducted by the United States Navy. The research is being done for Project Seafarer, which consists of the proposed laying of hundreds of miles of underwater communication cable for use by submarines. Of approximately fifty studies reported to date, only one indicated possible damaging effects from exposure to electromagnetic fields. This study

reported a rise in the serum triglycerides of human subjects 24-48 hours after they had been exposed, but this condition subsided shortly afterwards. (Consistently high serum triglycerides can, at times, be associated with a susceptibility to heart disease.) In this study, the magnetic field was of much greater intensity than that of a high tension wire while the voltage gradients were much lower. However, the results of this study prompted a West German investigation to explore the effects of high voltage fields on serum triglycerides. No effects were reported. Other studies in Europe include one in France where two groups of people, one living near a line and the other farther away, were analyzed for the amount of medical care they received. No difference was found between the groups in their frequency of visits to doctors or in the amount of medicine used. Experiments in West Germany and Sweden using human subjects failed to show biochemical, physiological, or subjective disturbances in the test subjects.

It should be noted at this point that most of the studies which have reported deleterious effects have had flaws in their methodology which make their results questionable. For example, the experiments by Hamer (1968), Konig (1974), Noval (1976), Giarola and Kreuger (1974) and Marino, et al. (1976), while generating positive results, all suffered from inadequate experimental procedure which detracted from their validity and therefore provided no reason to change the general conviction that there is an absence of biological effects which can be directly attributed to exposure to electromagnetic fields.

Cardiac Pacemakers

One concern frequently mentioned with regard to overhead transmission lines has to do with cardiac pacemakers. The nature of the pacemakers makes

them extremely sensitive to electromagnetic fields. However, only certain types of pacers would be affected - those which depend on sensing heart signals in order to begin helping the heart along when it falters. These pacers screen out interference when in operation, but, when they are still because the heart is functioning normally, electromagnetic interference could cause them to begin functioning. This results in the pacer competing with the heart (i.e., the heart is receiving both biological signals and signals from the pacer). While this situation is a strain to some degree, it is generally not considered to place the patient in great danger and is preferred to a situation where no stimulation at all is received from the pacer when necessary. Although transmission lines may bring about such a situation, other sources of electromagnetic fields present an equal danger (microwave ovens, radar, electric shavers). There has, however, not yet been a documented case of death or other serious occurences in pacemaker patients which can be attributed to electromagnetic fields.

Shocks

Another major concern has to do with shocks. While shocks do occur, they do not seem to be frequent or of a serious nature. In a study conducted by the New York State Agricultural Resources Commission, eighteen farmers, whose land was under 765 KV lines, were surveyed. One farmer reported receiving a heavy shock while working in the rain, three reported a few light shocks while the remainder had not experienced shocks of any kind.

Conclusion

In conclusion it can be said that the overwhelming bulk of scientific information collected to date indicates an absence of deleterious biological

effects ranging from genetic to behavioral areas in plant, animal and human subjects. Certain effects, such as ozone production, shocks, noise and radio and television interference can be annoying, but are far from dangerous and often unavoidable. In response to public concern over these effects, Ontario Hydro has established a Demonstration Center at Essa, where most of the problems mentioned here are explained and possible hazards are demonstrated along with techniques for alleviating any apparent danger. However, ruling out possible dangers would be a mistake and open-mindedness must be maintained. Any effects would be very difficult to pinpoint and studies must be extensive and rigourously controlled in order that results be as reliable as humanly possible.

Aesthetic Aspects

As Man has strived to understand the man-environment relationship, the ill-defined term 'aesthetic' had been used to describe various landscapes. To describe something as aesthetically pleasing, an individual value judgement must be made based on one's visual perception of the landscape, event or object.

Visual perception of regions is usually achieved through a composite mental image made up of many views over time. Any rapid and abrupt change will greatly alter this visual perception and most often, in a negative way. If changes in the environment occur slowly over a long period of time, the individual is able to adapt to the changes and accepts them with less emotional disruption.

The way an individual perceives a phenomenon is influenced by a range of physical and psychological factors as well as the time and mode of

viewing. These controlling factors were discussed in detail by A.V. Vaughan in the report, Structural Design: Visual and Social Considerations (1974). Because of the number of variables involved, an individual's perception will vary and fluctuate. The aesthetic beauty of a phenomenon will, likewise, vary between individuals and over time.

Defining aesthetic areas during corridor planning has been a problem for all utility companies. R. Kates in The Pursuit of Beauty in the Environment (1966, p. 22) outlines the problems of defining aesthetic areas:

> Except within the vaguest limits, beauty cannot be described; therefore it cannot be defined. It cannot be measured in quantity or quality; therefore it cannot be made into the basis of a science. It has always proved impregnable to the frontal attacks of Aestheticians.

As electric consumption increases, it has been necessary for utility companies to expand their services. When undertaking expansions, electric companies are often faced with the reaction of individuals who can see the need for increased facilities, but are extremely resistant to the construction of lines in their area. The explanation of this paradox has long eluded planners.

Aesthetics in Corridor Planning

It is extremely difficult to measure the visual impact the construction of new line will have on individuals. Ontario Hydro realizes that the visual impact cannot be totally eliminated within present economic and technological limitations. They have tried three approaches to minimize the unwanted impacts. These are: a) following a list of 'do's and don't's' guidelines; b) using a statistical exercise in which the degree of visibility and number of viewers is calculated; and c) a system based solely on expressed aesthetic preferences.

The basis of the 'do's and don't's' method was to place the line where people would be least upset. Some examples of the guidelines which are very site-specific follow:

- avoid crossing over or near roads which have steep vertical slopes;
- avoid crossing through well defined enclosed spaces;
- avoid crossing near intersections on roads;
- avoid crossing perpendicular to a sequence of lines in sight of a landmark; and
- avoid silhouetting on the horizon.

The problem with this technique is that the list is based on Hydro's past experience. Each new line constructed will have unique areas and 'first time' decisions will have to be made, without specific rules to guide the construction decision.

When the visibility and number of viewers is calculated and manipulated statistically, the amount of data obtained is great. The general rule for tower and line placement would be to "locate them where least visible and away from where people are presently located". No consideration was given to the quality of the unsettled areas of land.

The system of corridor planning based on aesthetics is somewhat complicated. Ontario Hydro is attempting to follow this method, along with following specific site rules to some degree, when planning any new corridor construction. The approach is outlined as follows:

> The visual analysis is composed of four interlocking methodologies:
> - a visual analysis methodology which operates at a Provincial scale to assist in establishing study area boundaries by determining in a very general sense, the large, visual high-constraint area.
> - a visual analysis methodology which operates at a Regional scale within a defined study area to assist in determining broad band corridors (1 mile to 10 miles in width) which link load centres to generation sites.

- a visual analysis methodology which operates at the local or site specific level to assist in the location of the actual route of the proposed transmission line within the previously defined course corridors.
- a methodology to assist in the determination of remedial measures to minimize the predicted visual impact.

(Vaughan, 1974)

Following these four methodologies, Ontario Hydro attempts to predict the visual impact of any changed, by examining the process in which man recalls images of his environment. This method involves great detail in the production of overlay maps outlining the best and the worst areas, important and less important areas, and sensitive areas. This method is considered the most thorough. The outcome of the planning process results in a series of tradeoffs. Technically the planner has to operate within the natural laws of physics, chemistry and engineering. Ecologically he tries to maintain a balance between nature and limit the adverse effects of his presence. He tries to provide what society wants in a manner acceptable to society. The planner must also facilitate the needs and demands of special interest groups. The most important influencing factor is often economics, but all of these factors should be weighed before the best corridor route is selected.

The Pacific Gas and Electric Company, in San Francisco has also published several reports dealing with the problems of visual impacts of service corridors. They acknowledge the fact that Hydro structures are constructed considering compatibility with the landscape, visibility and cost. The visual analysis techniques used are in the experimental stages.

In Impact Analysis Methodology for Transmission Line Planning Corridors the Pacific Gas and Electric Company make the assumption that "man-made facilities of any type can be designed and sited in the landscape without

creating significant negative visual impact" with the exception of the following six conditions:

a) When lines are visible in areas officially designated for the preservation of scenic values;
b) When lines are located in areas which are prone to long term scars and swaths as a result of grading or clearing operations;
c) When parallel lines are not coordinated or when the number of lines becomes visually dominant;
d) When lines are not compatible or in scale with the major visual patterns or features of their setting;
e) When lines occupy a major portion of the viewed landscape; and
f) When more than one line or a coordinated set of lines is visible from any one viewpoint.

The visual conditions which will normally cause a transmission line to have an adverse visual impact are then identified and mapped, used to determine alternative planning corridors, used as indicators of impact coincident with the alternatives, and used to compare the relative merits of the alternatives. Through a series of numeric ratings, the compilation of various matrices and the process of elimination the best corridor route is selected. The whole process, however, is based on an individual visually accessing a landscape. The statistical process used is experimental and open to much criticism.

Over the years public pressure has forced utility companies to make the corridors as inconspicuous and aesthetically pleasing as possible, within their economic constraints. Many ideas have been proposed to make corridor right of way management a creative art.

On a provincial scale, Hydro corridors occupy thousands of acres of land. The lines cross productive agricultural land, concrete urban landscapes and land that could be classified as desolute and waste. To make the hydro lines and towers fit into these varied environments, many structural designs and right of way management techniques have been used. High voltage hydro lines have been strung on straight concrete pillars in the city, and

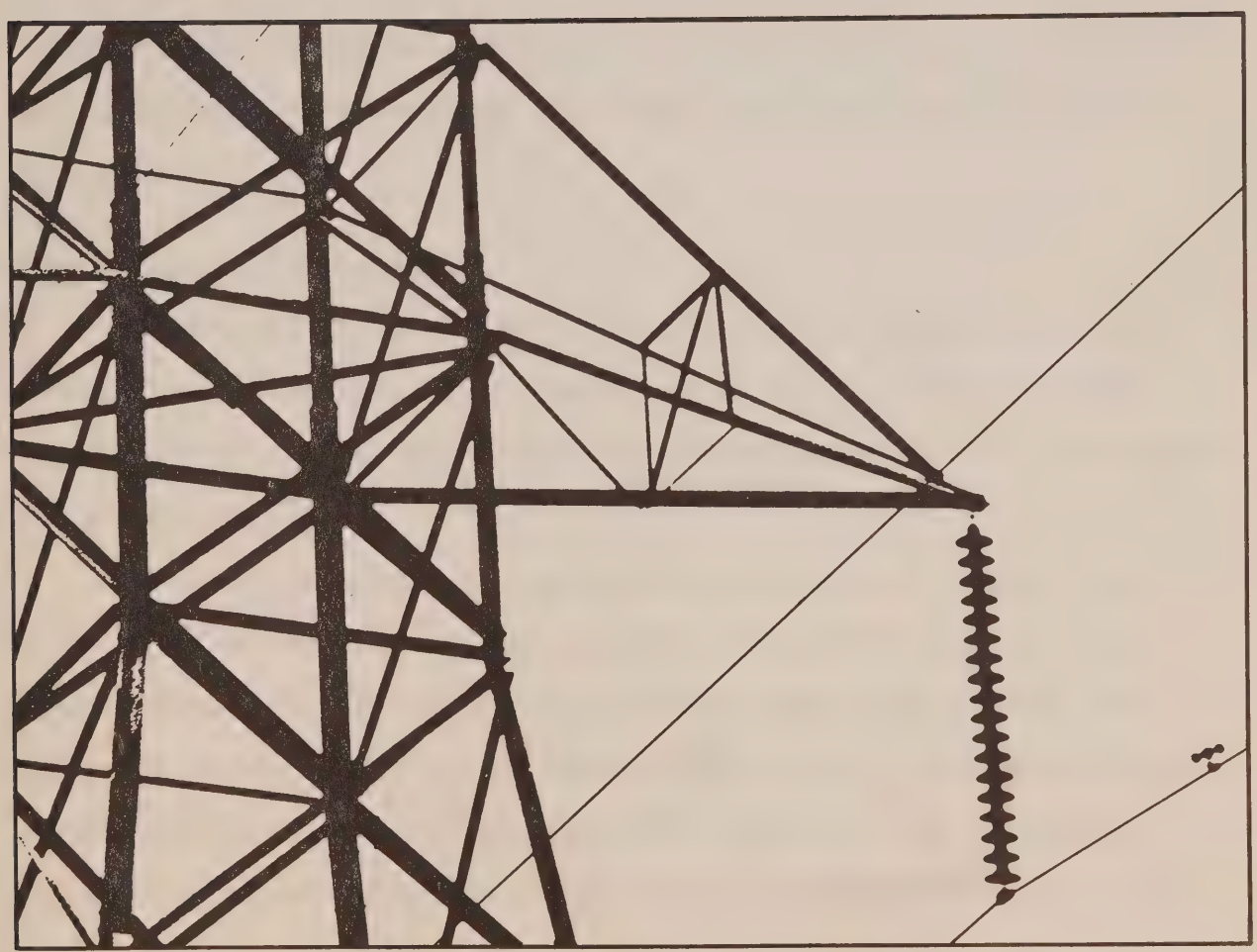
various steel structures in the country side. The degree of fit of any of these structures into a given environment is once again a judgement, based on an individual's visual perception.

Management of the corridor in more or less a "natural way" is another method of making the corridor aesthetically pleasing. A one hundred foot wide scarred pathway cut through bush, city and field is not considered aesthetically pleasing by most people. In the case of forests, vegetation under the line is restricted by the use of herbicides. The mental image created is one of "wasted land". Closer to the city limits where land is at a premium the image of wasted space is perhaps more irritating to residents. In the rural areas most of the Hydro's easement is farmed, and the only wasted land is around the base of the towers.

In France, hydro companies consider the environments' sensitivity when routes are being built. Right of ways through bush areas are cut with a jagged edge to give the area a more natural appearance. Natural vegetation of the area is replanted and allowed to grow after the line has been constructed. The foliage is cut and cleared only if there is a danger of it interfering with the lines. This gives the ground under the lines a multi-leveled canopy appearance. The basic underlying solution to making hydro lines aesthetically pleasing, is to plan the corridors and design the structures with the environment.

Chapter 3

Physical Analysis of the Study Region



Chapter 3 Physical Analysis of the Study Region

Introduction

The purpose of this chapter is to describe the physical characteristics of the study region and to analyse the degree of physical variance between the transmission corridors studied and their respective controls as well as the variance between the 500 KV and 230 KV transmission corridors. This analysis was essential to identify any exogenous factors which may affect the socio-economic analysis in the balance of this report. A general overview of the physical nature of the region will be followed by a description of the physiographic regions included within the study area and a statistical analysis of more specific, local physical characteristics. The characteristics considered statistically were physiography, soil capability for agriculture, land capability for forestry and land capability for recreation.

General Physical Description

Southern Ontario is an area of relatively modest relief with a total fluctuation in elevation of approximately 1,650 feet. The major factors responsible for the shaping of this region are attributable to its geological and glacial history.

The underlying strata of Southern Ontario consist of limestone and shale layers of the Paleazoic Age, combined with sandstone and dolomite. These materials were deposited by sedimentation through an ancient, salt water body on top of very old Precambrian rocks. Due to the internal forces of the earth and the retreat of salt water, the bedrock and sedimentary material was heaved and warped. Contortion of the bedrock resulted in many

surficial features which are now evident.

Prior to the four glacial periods of the Pleistocene Age, erosional processes contributed significantly to the present physiography of Southern Ontario. During the period between warpage and glaciation, this area was exposed to extensive alluvial erosion for approximately 250 million years. An excellent example of the results of this erosional process is the Niagara Escarpment. It was formed by the differing erosional characteristics of the harder dolomite and underlying softer sedimentary material.

Glaciation has been the most recent factor which has shaped the landscape of this region, specifically the Wisconsin Continental Glacier which covered the area only 13,000 years ago. This glacier, in its advancement, formed numerous features such as drumlins and moraines. During retreat, fissures formed divisions which gave the continental glacier the characteristic of lobes. It was the retreat and minor readvancements of these lobes that acted as the major force in shaping the present glacial topography. A minor split in the Ontario Lobe was responsible for the formation of the Oak Ridges interlobate moraine which is a major feature of the 500 KV corridor. The combined effects of bedrock warpage, Pleistocene glaciation and constant erosion all contribute to the present diverse topography of Southern Ontario.

This physiography has proven to be economically and socially valuable, through such features as the Niagara Escarpment which has provided materials utilized in construction and is also valuable as a natural recreational resource. Many other examples exist of social and economic benefits derived directly from the physiography of Southern Ontario.

Physiographic Regions

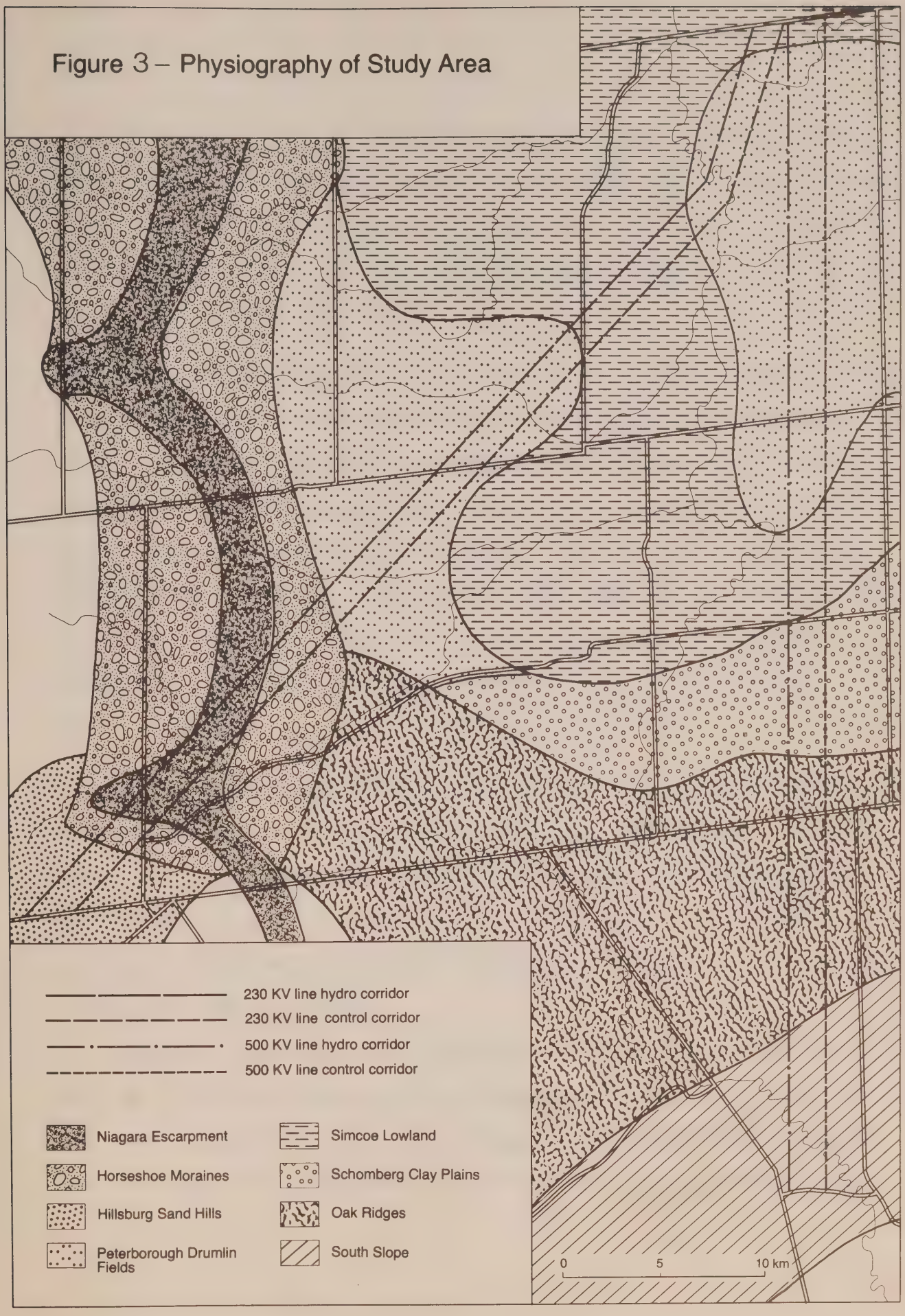
The study area covers eight physiographic regions in Southern Ontario as described by Chapman and Putnam (1966). A brief discussion of these regions will follow in order to determine those physical characteristics which may affect the analysis of the area. The information given for each region will include predominant topography, landforms, soil type and other factors which affect the physical continuity of the study region. Physiographic regions are illustrated in Figure 3.

1. The Niagara Escarpment is a dramatic feature which extends south through the Niagara River and northwards to Collingwood where it continues west around Georgian Bay and north through the Bruce Peninsula. This feature stands in sharp contrast to the general topography of Southern Ontario, which is glacial in origin. The Escarpment is a cliff of preglacial origin with a hard upper layer of Silurian dolomite which gradually slopes beneath glacial deposits to the west. The Escarpment's east slope is a steep face carved out of red shale and limestone with the exception of several segments which were eroded during the Pleistocene Age and covered by glacial action.

In the study region the highest portion of the Escarpment is 1,600 feet above sea level, however, most of it is obscured by hummocky, bouldery, moranic features and other glacial formations. It is through this area that the 230 KV transmission corridor passes.

2. The Horseshoe Moraine is a narrow region, running parallel to both sides of the Niagara Escarpment in the vicinity of the 230 KV study area. This area is composed of eroded material from the upper portions of the Escarpment as well as material deposited by the Wisconsin Glacier.

Figure 3 – Physiography of Study Area



Within the region, the hydro corridor passes over a terrain of stony knobs, ridges, sand and gravel plains and some swamp-like lowlands. Extractive industries, concentrating on gravel deposits, have been active in this region for many years. The soil of the Horseshoe Moraine is composed of 18 to 20 inches of Huron Clay Loam.

3. The Hillsburg Sand Hills was the first area to be exposed when the latest glacier retreated. It has an elevation of 1,400 to 1,600 feet above sea level. The general topography is a rough terrain of sandy materials dominated by features of glacial origin such as swampy valley floors, outwash plains, spillways, moraines and knob hills. The soil type in this area is predominantly fine, sandy loam which has proven ideal for the production of potatoes on areas of adequate slope. In the study area, north-west of Orangeville, extractive industries have utilized the reserves of sand gravel and peat.

4. The Peterborough Drumlin Field is an area of rolling glacial topography with numerous surface flutings, eskers, clay flats and drumlins. In certain areas, the drumlins have been altered by the alluvial action of previous glacial lakes, leaving a bouldery surface. This region lies between the south-western portion of the Simcoe Lowlands and Lake Simcoe and encompasses an area of 1,750 square miles.

Both the 500 KV and 230 KV transmission lines at the most northern portions of the study area pass through this region. The hydro lines pass over some valleys with swampy basins which are remnants of the previous ice age. The soil type in the study area of the 500 KV line is Bondhead loam.

5. The Simcoe Lowlands are bordered by Lake Simcoe and Georgian Bay, and encompasses an approximate area of 1,100 square miles. Both the 230 KV and 500 KV study corridors pass through this region which lies south-westerly, and adjacent to, the Peterborough Drumlin Field. This entire area was the basin of Lake Algonquin, which was of the Pleistocene Age, hence, numerous shorecliffs, and beach-like features lie on its periphery. Canada Camp Borden Forces, known for its large sand deposits, lies in a central part of this feature. Silt and clay are also common to this physiographic region.

6. The Schomberg Clay Plains is a small region over which the approximate midpoint of the 500 KV study corridor crosses. The area covered by this feature is a 475 square mile clay plain. A heavily drumlinized till plain underlies the clay plain, although some of the larger drumlins are not completely covered. The substrata of the study route in this region is Schomberg catena with well drained silty clay.

7. Oak Ridges is the major physiographic feature affecting the topography of the 500 KV study corridor area. This large, interlobate moraine serves as the north-south drainage divide for south-central Ontario. The highest point of this moraine, over which the hydro transmission line passes, is 1,175 feet above sea level. Topography is hilly and composed of sand and gravel material, with a knob-basin relief, a characteristic moranic feature. Soil in this region is composed of sandy loam, sand or gravelly sand of the Pontypool series to a depth of 20 to 30 inches.

8. The South Slope physiographic region encompasses the southern most portion of the 500 KV study area. The primary feature of this region is that it slopes downwards in elevation in a southerly direction from the Oak Ridges moraine to the north of this region. Numerous gullies have been eroded following the natural drainage pattern. The study area has a rolling topography which is faintly drumlinized. Soil composition is primarily King Clay loam, which contains a blend of shale and limestone.

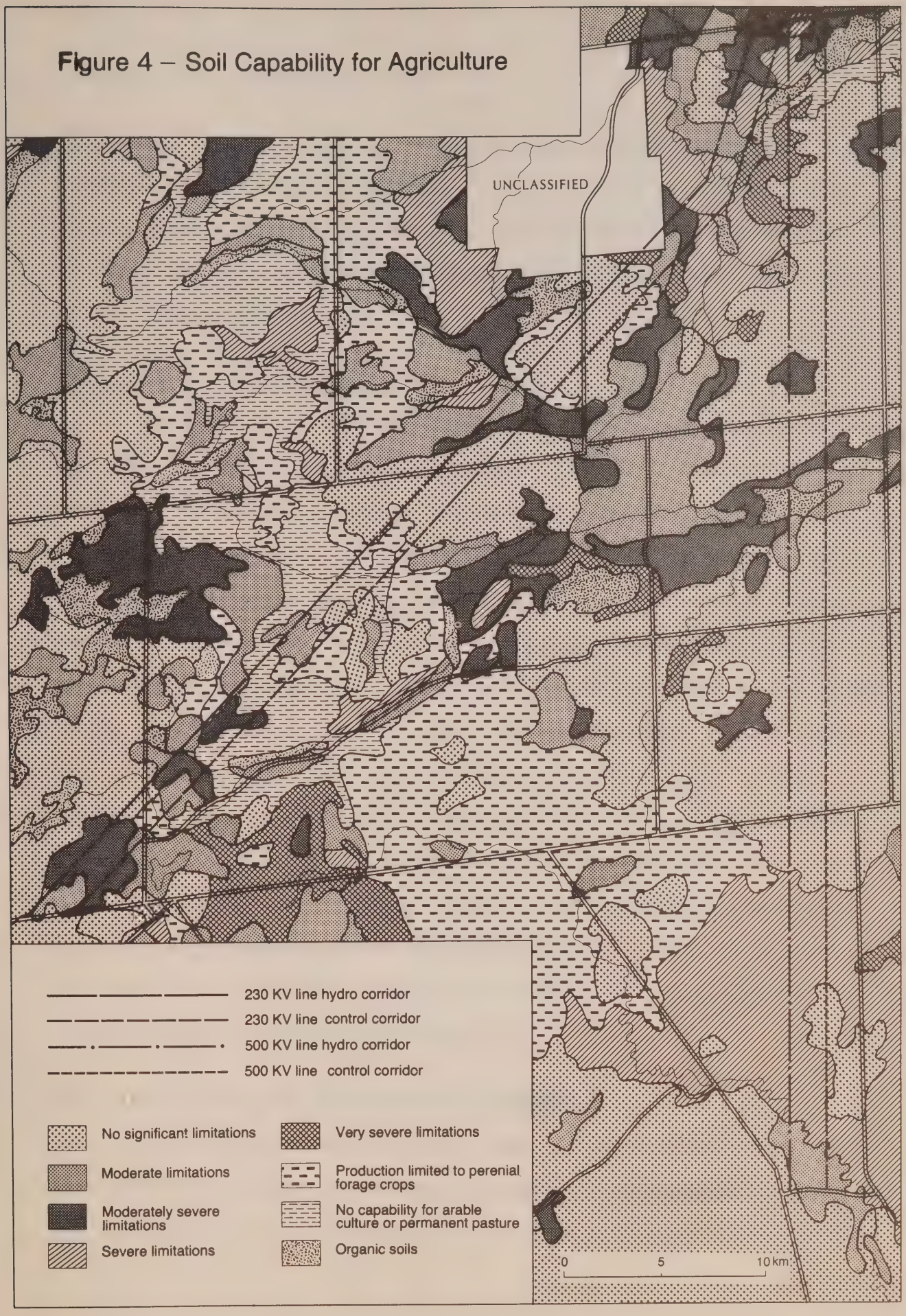
Capability for Agriculture

Soil Capability for Agriculture as outlined by the Canada Land Inventory indicates the potential of a given area for agricultural purposes utilizing modern methods of cultivation. The limiting factors within each classification are the basis for assessment. Areas requiring a high input to attain their potential are classed under present conditions. The limiting factors included in an area's assessment are soil type and the relative concentration of natural conditions which facilitates flora productivity. Generalizations of these factors are the major determinants in the subsequent classification of areas for their Soil Capability for Agriculture. Soil Capability for Agriculture for the study region is illustrated in Figure 4. Descriptions of the classes of capability are provided in Appendix II.

Capability for Forestry

Land Capability for Forestry under the Canada Land Inventory, classifies areas according to their inherent ability to grow commercial timber. The criteria for classification are based on the natural conditions which presently exist in the area. Data analysed includes soil type, soil profile, moisture,

Figure 4 – Soil Capability for Agriculture



fertility, vegetation, climatic conditions and landforms. Generally, only through extremely high capital input, could an area's inherent ability to produce commercial timber be improved. Land Capability for Forestry for the study region is illustrated in Figure 5 and descriptions of the classes are provided in Appendix II.

Capability for Recreation

Within the context of this report, the recreational characteristics of the study area were considered because of the increasing importance of this resource. The quality of outdoor recreation is independent of any soil classification for agriculture or capability for forestry. However, recreation does rely on the physiographic characteristics and existing developmental technologies for the exploitation of natural amenities for recreation. Increasingly, the Niagara Escarpment on the 230 KV Hydro line and Oak Ridges on the 500 KV Hydro line are providing a greater percentage of the recreation for Southern Ontario. This has developed due to the existence of such features as tumbling waterfalls, pastoral settings, deep gorges and wooded valleys. "Thus, the specific unique attributes as well as all other physiographic, biological and cultural features of each unit that influence its potential for recreation must be evaluated" (Hills, 1970, p. 167). Land Capability for Recreation is illustrated in Figure 6. Again, descriptions of the classes are provided in Appendix II.

Statistical Analysis of Hydro and Control Corridors

Prior to undertaking the analysis of real estate transactions and field research it was necessary to determine whether the landscape in the hydro and control corridors is significantly different and what effect these factors

Figure 5 – Land Capability for Forestry

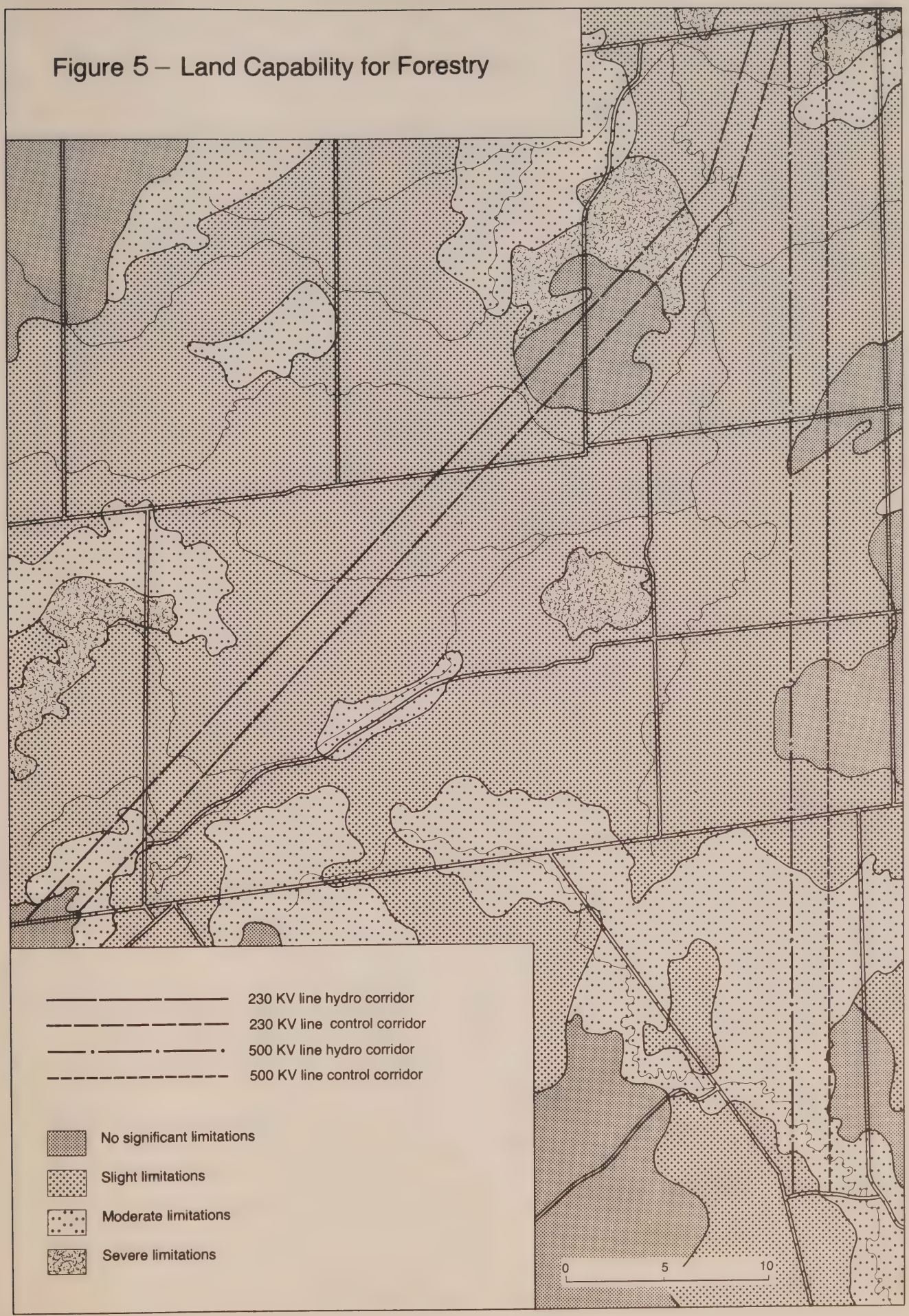
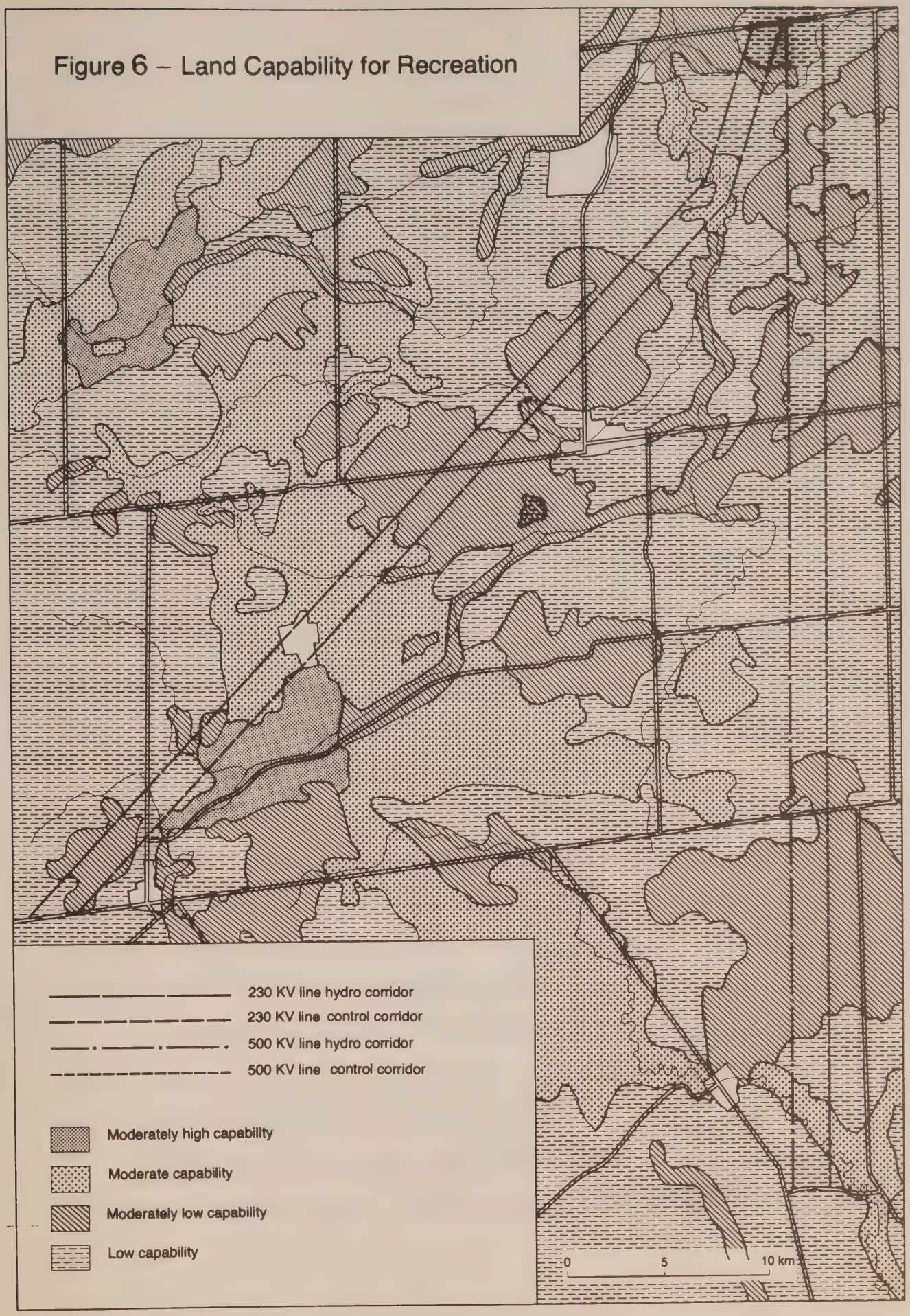


Figure 6 – Land Capability for Recreation



may have on land values and other impacts. If there is no significant difference between the corridors, the analysis of real and perceived effects will be facilitated.

In deciding whether there was any significant difference in physical dimensions between the two corridors and their respective controls, various parameters were considered. These include: Physiography, Soil capability for agriculture, Land capability for forestry and Land capability for recreation. The parameters were sampled and chi-square tests were carried out to determine if there was a statistically significant difference between the actual corridor and its respective control corridor.

Comparison of Hydro and Control Corridors

To determine the placement of the control corridor statistical tests were carried out on control lines one mile to the east and west sides of the hydro corridor. The control of least significant difference for the 230 KV and 500 KV hydro lines was on the east side of each line.

The null hypothesis postulated was that there is no significant difference between the hydro and control corridors in respect to parameters measured. A number of significance levels are provided so that the reader can choose to interpret the results at the level desired. If the calculated X^2 does not meet a certain threshold size of the significance levels given, the null hypothesis is accepted. Summarized tables for the tests are provided (Tables 3.1 and 3.2). Measurement procedures and tables for the individual tests are provided in Appendix III.

No significant differences were found between the hydro and control corridors for the parameters of physiography, soil capability for agriculture,

Table 3.1

Statistical Comparison of Physical Characteristics - 500 KV Line and East Control Corridor

Parameter	Calculated X^2	Degrees of Freedom	Levels of Significance .2	.1	.05
Physiography	7.24	4	5.99	7.78	9.49
Agriculture	8.47	5	7.29	9.24	11.07
Forestry	3.79	2	3.22	4.60	5.99
Recreation	0	1	1.64	2.71	3.84

Table 3.2

Statistical Comparison of Physical Characteristics - 230 KV Line and East Control Corridor

Parameter	Calculated X^2	Degrees of Freedom	Levels of Significance .2	.1	.05
Physiography	7.78	4	5.99	7.78	9.49
Agriculture	6.74	5	7.29	9.24	11.07
Forestry	.51	3	4.64	6.25	7.82
Recreation	4.70	2	3.22	4.60	5.99

land capability for forestry and land capability for recreation. It may be assumed, therefore, that any discrepancy in land values or field research results would not be attributable to any physical variation between each line and its respective control.

Comparison of 500 KV and 230 KV Corridors

The objective of this section is to determine if there is any significant differences in the landscape between the study areas of the 500 KV and 230 KV hydro lines. Again, analysis of the economic and social effects of the hydro lines will be facilitated if there is no significant differences between the lines.

The methodology was the same as in previous testing but, in this test, the hydro and control corridors were combined for each study area. The parameters measured were soil capability for agriculture, land capability for forestry and land capability for recreation. In order to fulfill the requirements of Chi-square testing, it was necessary in all cases to group certain classifications together. Table 3.3 shows summarized results with several levels of significance given so that the reader may interpret the results at the chosen level of significance. Tables for the individual tests are given in Appendix III.

Table 3.3

Statistical Comparison of Physical Characteristics - 500 KV and 230 KV Lines

Parameter	Calculated X^2	Degrees of Freedom	Levels of Significance		
			.2	.1	.05
Agriculture	205.7	4	5.99	7.78	9.49
Forestry	9.68	2	3.22	4.60	5.99
Recreation	52.5	1	1.64	2.71	3.84

Physiography could not be tested because certain features were unique to each study area. Consequently, these features could not be aggregated into classes to satisfy testing requirements. In the 230 KV study area, unique features were the spillways of the Hillsburg Sand Hills and kame moraines of the Horseshoe Moraine region. Individual characteristics of the 500 KV study area were the drumlins of the Peterborough Drumlin Field and clay plains of the Schomberg Clay Plains region. Other major features affecting the similarity of the study areas are the existence of the Niagara Escarpment in the 230 KV area and the Oak Ridges moraine in the 500 KV study area.

As Table 3.3 indicates, significant differences were found for all tested parameters. Although the necessity of aggregating classes to satisfy testing requirements lowers the reliability of the tests, substantial differences exist.

The soil capability for agriculture in the 500 KV study area shows a high percentage (63%) of Class 1 land with a relatively even distribution through the remaining Classes (Appendix Table III-9). The 230 KV study area has a comparatively even distribution through Classes 1, 2 and 3 with a relatively high percentage (32%) of Classes 6, 7 and 0. This indicates a generally lower soil capability for agriculture in the 230 KV study area.

A comparison of the capability for forestry in the study areas shows a high percentage of Class 2 land in both areas, representing 66% of the 500 KV area and 85% of the 230 KV area (Appendix Table III-10). The major difference between the two areas is a higher proportion of Class 3 and 5 land in the 500 KV study area. This indicates that the 230 KV area has a higher land capability for forestry than the 500 KV study area.

In the analysis of land capability for recreation, neither area demonstrated a high potential for recreation as both areas were characterized by an absence of Class 1 and 2 land (Appendix Table III-11). Within the 230 KV area, there is a high percentage (74%) of Classes 3, 4 and 5 land compared to a considerable lower percentage (48%) in the 500 KV area. Although neither area has a high potential for recreation, the 230 KV area is more adequate for recreation than the 500 KV study area.

These results show that there is a significant difference in the parameters measured for the study areas. This difference, combined with the obvious physiographic differences, requires that these factors be considered in any land value or sociological comparison.

Chapter 4

The Effects of Transmission Corridors on Real Estate Transactions

Chapter 4 The Effects of Transmission Corridors on Real Estate Transactions

Introduction

An examination of previous reports has shown that although the question of the impact of hydro transmission lines on real estate values has been raised and studied many times using various methods, the nature of the impact has not been conclusively established. Generally, there is a lack of scientific data and much of the reasoning in past reports has been based on hearsay or small sample sizes. By using a large sample and statistical analysis techniques, some conclusions can be drawn as to the actual effects on agricultural and estate-residential properties in the study area.

Data Collection

Data was collected from the records of the Regional Registry Offices for the study area, located in Barrie, Newmarket and Orangeville. Information was drawn from Abstract Books and, where necessary, from instruments. The collected information for each sale included: instrument number, date of registration, type of conveyance, name of the grantor and grantee, consideration and size of property.

Information was obtained for the period 1967 to 1977 for survey lots crossed by the hydro lines and survey lots crossed by the control lines. By comparing the number of transactions made each year during this time period, the size of properties involved and the sale price per acre, any patterns, similarities and noteable differences between corridors can be ascertained. The period from 1967 to 1977 was chosen in order to reveal trends, if any,

and in the case of the 500 KV line, to identify any changes during or after line construction.

The survey lots transversed by the transmission lines which were examined included properties abutted, but not encumbered by the line. In such cases, the close proximity of the line can be reasoned as having effects similar to those on properties actually crossed. The control lines drawn at a one-mile distance from the hydro line were regarded in a similar manner.

A complete collection of data for all the lots crossed by the lines and their controls was not possible. In some cases either the acreage in question or the consideration could not be established from the Regional Office Abstract Books or the instruments. Those which were not arm's length transactions, that is, those property transfers involving artificially low values as a result of marriage or inheritance were eliminated. Sales to the Township for road widenings and transfers involving the Veterans Land Act were eliminated as well. It is very important to note that sales of property to Ontario Hydro for rights of way are not included in this analysis. This becomes especially significant in the analysis of frequency of sales by year.

Approximately 1,660 transactions were recorded, 653 of which had to be eliminated for the reasons outlined above leaving a total of 1,007 for analysis.

Assumptions for Analysis

A number of assumptions have been made to account for the data that was necessarily eliminated and the information that was impossible to obtain given the time and resources available. These assumptions are as follows:

1. The number of transactions eliminated for the above reasons do not affect the sample significantly, based on the assumption that an equal number of transactions of the types eliminated were made on each corridor.
2. The analysis of the differences in physical characteristics of each line and their respective controls showed no statistical significance (Chapter 3). Therefore, the properties do not vary in their value due to inherent physical properties.
3. The large sample that was collected enables an assumption to be made on the value of improvements made on individual properties. To take these into account would require a lot by lot assessment of all buildings and other improvements which was an impossible task for this study with time and resources as limiting factors. It is assumed then, that any improvements made on properties were of similar number and value for each line and control.
4. Since the control lines were parallel and relatively close, the factors of accessibility and urban influences from Toronto, Barrie and Orangeville would be the same.
5. A comparison of the lines with their controls has not taken inflation factors into account. It is assumed that the areas are exposed to the same inflationary influences.

Analysis Methods

The data for usable transactions was coded by an identification number, year, consideration, size and price per acre. Size categories were also assigned as follows:

Size Categories (acres)

1. 0.1 - 0.9
2. 1.0 - 4.9
3. 5.0 - 9.9
4. 10.0 - 49.9
5. 50.0 - 99.9
6. over 100

Fortran computer programs were used to sort the coded data by year and Size Category, to count frequencies of transactions and to calculate average price per acre for each sorted group. Tables summarizing frequencies and average price per acre for the 500 KV and 230 KV lines and their respective controls are provided in Appendix IV.

Given the nature of the data, few statistical tests were available to aid in analysis. Frequency information derived from the summary tables was used in Chi-square tests of significant difference. To fulfill the restrictions of minimum frequencies for Chi-square tests, in some cases it was necessary to aggregate categories.

The results of analysis are presented in the balance of this chapter. Tables showing relevant aspects drawn from the summary tables are included with the text. Chi-square values based on these tables are not included, but a summary of levels of significance for the tests is provided in Appendix Table IV-5.

Analysis of Data

Frequency of Total Sales

The frequency of total sales on both lines and their respective controls is very similar (Table 4.1). This indicates that the presence of the line does not affect the overall frequency of sales. However, the similarity

gives no indication of how the line might affect the size, type, timing of sale or selling price of the properties involved in the transactions.

Table 4.1

Frequency of Total Sales, 1967-1977

	Line	Control	Total
500 KV Study Area	306	315	621
230 KV Study Area	192	194	386

As Table 4.1 shows, a greater number of sales occurred in the 500 KV study area than in the 230 KV study area. The higher frequency of sales in the 500 KV study area could be due to its location and orientation in relation to Toronto and Barrie. The line runs almost parallel to major north-south access routes between Toronto and Barrie. It is an area desirable for commuters to Toronto and is therefore, suitable for development.

Frequency of Sales by Size Category

As indicated in the section dealing with the methodology of analysis, the sales data obtained was classified by size of the property involved. Frequencies by size category, including all years, are summarized in Table 4.2. For purposes of discussion in this and following sections, it was found convenient to discuss types of property by size in terms of the generalizations of small, medium and large. Small properties are those under 10 acres (Size Categories 1, 2 and 3). Medium size properties are between 10 and 50 acres (Size Category 4) and large properties are over 50 acres (Size Categories 5 and 6). It must be noted, that discussion and observations drawn in this section are in respect to frequencies of sales without regard to selling prices.

Table 4.2

Frequency of Sales by Size Category

	500 KV Line	500 KV Control	230 KV Line	230 KV Control
Size 1 (0.1-0.9A)				
Frequency	52	86	26	42
%	17.0	27.3	13.4	21.8
Size 2 (1-4.9A)				
Frequency	25	51	19	26
%	8.2	16.2	9.8	13.5
Size 3 (5-9.9A)				
Frequency	19	4	16	11
%	6.2	1.3	8.2	5.7
Size 4 (10-49.9A)				
Frequency	153	104	85	69
%	50.0	33.0	43.8	35.9
Size 5 (50-99.9A)				
Frequency	38	44	18	21
%	12.5	13.9	9.3	10.9
Size 6 (100+A)				
Frequency	19	26	30	23
%	6.2	8.3	15.5	12.0
Totals	306	315	194	192

A comparison of frequencies of sales by size category between each line and its respective control shows similar patterns in both the 500 KV and 230 KV study areas.

In both the 500 KV and 230 KV study areas, the controls had a greater number of transactions, by percentage of total sales, in the smaller size categories (under 10 acres) than did the lines. On the 500 KV control, small properties accounted for 44.8% of all sales and on the 230 KV control, 41% were of this size category. Both lines, on the other hand, had 31.4% of total sales in the small size category. This may indicate that land in the vicinity of the line is less desirable for owners of small properties and subdivision development than land at a distance from the line.

There was a greater frequency of sales in the medium size category (Size 4, 10-49.9 acres) on both lines than in their respective controls. Properties in this size range accounted for approximately one half of all sales on the lines (500 KV line, 50%; 230 KV line, 43.8%), as compared to about one third of all sales on the controls (500 KV control, 33%; 230 KV control, 35.9%). Properties in this size range are desirable for hobby farms and rural estates. The difference between the lines and controls might indicate that the presence of a line does not affect this type of development and, perhaps, may even encourage it by prompting the owners of large farms to divide their land into smaller parcels when a line transects their property. This suggestion is supported by the large number of Size 4 sales during the years 1968-69 on the 500 KV line when the present corridor was being established. Frequency of sales by year will be considered in more detail below.

Sales of larger properties (Sizes 5 and 6, over 50 acres) represented a minority of all sales and frequencies were similar in all areas. In each area, sales in this group accounted for approximately 20% of total sales. Most properties of this size are operating farms and the similarity of frequency of sales might indicate that properties of this type are not strongly affected by the presence of a hydro line.

The existence of significant differences between the lines and their respective controls was confirmed by Chi-square tests comparing frequency of sale by Size Category. The results show that the difference between the 500 KV line and its control is significant at the 0.001 level. The difference between the 230 KV line and control is less marked with a significance level of 0.2.

Comparing the frequencies of sale by size category for the 500 KV and 230 KV lines shows some difference between the two areas. A Chi-square test of the information presented in Table 4.2 shows a difference statistically significant at the 0.02 level. While the 500 KV study area had a larger proportion of sales in Sizes 1, 4 and 5, the 230 KV line had higher relative frequencies of Sizes 2, 3 and 6. Because of the inconsistency of this difference, another Chi-squared test was performed using frequencies grouped for small, medium and large properties. Although the difference was found to be no longer statistically significant (Significant at the 0.3 level), there was a trend for more medium size properties on the 500 KV line and more larger properties on the 230 KV line. This slight difference, in combination with the higher absolute frequencies of sales in Size Categories 1 through 5 on the 500 KV line, further supports the suggestion that the 500 KV study area is more developed than the 230 KV study area. The difference is not sufficient, however, to suggest that the impact of a 500 KV line is substantially greater than that of a 230 KV line on the size of properties sold.

Frequency of Sales by Year, 1967-77

When total sales for each year are considered, there is no overall trend in either the lines or controls but some patterns in fluctuations through the years are apparent (Table 4.3). In some aspects of the comparison of sales by years, the 500 KV and 230 KV study areas must be considered separately. The time period under analysis, 1967-77, encompasses the years of construction of the 500 KV line while the 230 KV line was established prior to 1967. An attempt was made to determine the effects the planning and construction of the 500 KV line had on sales during those years. Again, it should be noted

that discussion and observations in this section relate to frequency of sales by year without regard to sale price.

Table 4.3

Frequency of Sales by Year, 1967-1977

	500 Line	500 Control	230 Line	230 Control
1967				
Frequency	19	18	16	15
%	6.2	5.7	8.24	7.8
1968				
Frequency	76	38	27	28
%	24.9	12.1	13.9	14.6
1969				
Frequency	49	25	19	19
%	16.1	7.9	9.8	9.9
1970				
Frequency	23	24	16	15
%	7.5	7.6	8.24	7.8
1971				
Frequency	17	23	17	15
%	5.6	7.3	8.8	7.8
1972				
Frequency	29	26	28	24
%	9.5	8.2	14.4	12.5
1973				
Frequency	33	60	24	27
%	10.8	19.0	12.4	14.1
1974				
Frequency	16	41	16	18
%	5.2	13.0	8.24	9.4
1975				
Frequency	13	21	10	15
%	4.3	6.7	5.2	7.8
1976				
Frequency	16	20	13	8
%	5.2	6.3	6.7	4.2
1977				
Frequency	15	19	7	8
%	4.9	6.0	3.6	4.2
Totals	305	315	194	192

A significant difference in the number of sales per year between the 500 KV line and control was determined when Chi-square tests were carried out (significant at the 0.001 level). To avoid the possibility that the small size categories might exert a distorting influence on total sale numbers, the test was repeated eliminating Size Categories 1, 2 and 3 (Table 4.4). Again, a significant difference was established at the 0.01 level. The difference in sales then, cannot be attributed to the development of areas of small properties or subdivisions and further analysis of the nature of the differences is appropriate.

Table 4.4

Frequency of Sales by Year, 1967-77,
Size Categories 4-6

	500 KV Line	500 KV Control
1967		
Frequency	17	12
1968		
Frequency	64	28
1969		
Frequency	33	18
1970		
Frequency	16	13
1971		
Frequency	13	11
1972		
Frequency	14	10
1973		
Frequency	21	33
1974		
Frequency	11	23
1975		
Frequency	8	11
1976		
Frequency	7	9
1977		
Frequency	6	6
Totals	210	174

The major differences between the 500 KV line and control areas appear to be an increase in sales on the line in the years 1968-69 and an increase on both the line and control in the years 1972-74. The first of these differences can clearly be related to the impending construction of the 500 KV line.

On the 500 KV line there was a sharp increase in sales during the years 1968-69. During these years, Ontario Hydro was acquiring property for the right of way. As was mentioned previously, however, sales of property to Ontario Hydro are not included in this analysis. While there was also a rise in the number of sales on the control in these years, the increase is not as great. Some increase in sales was also found on the 230 KV line and control, which would indicate a somewhat active market, but again, these increases were not as marked as on the 500 KV line.

A further analysis of sales for the years 1968 and 1969 shows the distribution of sales by size category for the 500 KV line and control (Table 4.5). The Table shows that there were twice as many sales on the line and that medium size properties (Size Category 4, 10-49.9 acres) accounted for 59.2% of on-line sales over the two year period. Unfortunately because of the nature of the data, it was not possible to determine the details of these transactions to make a conclusive statement on the reason for the sales. It might be suggested that the medium size category experienced an active period of sales due to the division of larger farms into smaller parcels as considered earlier. On the other hand, the presence of the line might have been a threatening influence to the owners of estate-residential properties and hobby farms encouraging these owners to sell and move away from the area.

The obvious response seen for medium size properties was not found for smaller or larger properties. During 1968-69, sales of small properties,

Table 4.5

Frequency of Sales during 1968-69 by Size Category - 500 KV Line and Control

	500 KV Line	500 KV Control
Size 1 (0.1-0.9A)		
Frequency	18	11
%	14.4	17.5
Size 2 (1.0-4.9A)		
Frequency	6	6
%	4.8	9.5
Size 3 (5.0-9.9A)		
Frequency	4	0
%	3.2	0
Size 4 (10.0-49.9A)		
Frequency	74	27
%	59.2	42.9
Size 5 (50.0-99.9A)		
Frequency	13	11
%	10.4	17.5
Size 6 (100+A)		
Frequency	10	8
%	8.0	12.6
Totals	125	63

(Size Categories 1, 2 and 3, under 10 A.) accounted for 22.4% of sales on the line and 27.1% of sales on the control. Larger properties (Size Categories 5 and 6, over 50 A.) were responsible for 18.4% of sales on the line and 30.1% of sales on the control.

A Chi-square test of the information displayed in Table 4.5 showed a trend but not a statistically significant difference (significant at the 0.3 level). A second test, grouping properties into categories of small, medium and large, showed a stronger trend (significant at the 0.1 level). From these results and the analysis above, it is concluded that, where there is an impact of impending construction, it is seen on properties in the 10 to 50 acre size range.

The second area of difference between the 500 KV line and control was a rise in sales on the line in 1972-73 and on the control in 1973-74. This period coincides with the actual construction of the 500 KV line. In both cases sales of properties in Size Category 1 (0.1 - 0.9 A.) and Size Category 4 (10 - 49.9 A.) accounted for the majority of sales. However, because the peak is not restricted to the 500 KV line, the construction of the line cannot be suggested as a cause of the increased sales. It is more probable that a generally active market was responsible for the increased sales.

Sharp fluctuations in the frequency of sales during the years 1967-77 are not found on the 230 KV line and control. As indicated previously, there was a slight increase in sales on both the line and control in 1968-69. Both the line and control also showed an increase in sales in 1972-74. This increase further supports the suggestion above that the increase in sales in the 500 KV study area in the same period was due to a generally active real estate market. In all cases of increased sales, properties in Size Categories 1 and 4 accounted for the majority of sales. The patterns of frequency of sales were similar for both the line and control. A Chi-square test showed no statistically significant difference between the two areas (significant at the 0.9 level).

Because the 230 KV line was established prior to 1967, the variations in the frequency of sales cannot be attributed to activity in the planning or construction of the line. The fluctuations must be interpreted as resulting from variations in the activity of the real estate market generally. It is important to note, however, that throughout the 1967-77 period, properties in proximity to the line do not appear to have been adversely affected and sold with similar frequency to properties at a distance from the line. It might be suggested from this that, in the longer term, the presence of the line has no substantial effect on the frequency of land sales.

Analysis of Sale Prices

In the two preceding sections, patterns of frequency of sales by size and year were identified. The comparisons between lines and controls were drawn without regard to the selling price of the properties involved. While few strong differences were noted in frequency of sales, there is a possibility that properties on the line sold for substantially lower prices than comparable properties at a distance from the line. This possibility necessitates analysis of sale prices of properties on the lines and controls.

The data collected allows for the comparison of market value by the selling price per acre of properties sold. So that sales of properties of all sizes would be comparable, the price per acre was determined for each transaction. Average price per acre was then calculated for each of the sorted groups displayed in the summary tables provided in Appendix IV. These averages may be compared in a number of ways such as average price per acre for each year or size category.

Price per Acre by Size Category

When the average price per acre figures are compared for both the 500 KV and 230 KV lines and their respective controls, some differences are readily apparent. The comparisons for each Size Category for lines and controls may be made by referring to row totals on the summary Appendix Tables IV-1-4.

The most apparent observation is that, in all cases, the average price per acre for smaller properties is much higher than for larger properties. This feature is readily explained. Smaller properties which are often residential estates or hobby farms generally sell at a higher price per acre than

large properties which are more likely to be operating farms. Also, when improvements are made on a small property, the average selling price per acre is naturally higher than when improvements of a similar value are made on a larger property (i.e. on a larger property, the value of improvements is averaged over more acres). If this factor is ignored and comparisons are made strictly within each size category, the average value per acre will be seen to be substantially higher on both controls than on the lines. In both the 500 KV and 230 KV study areas, control values are higher in every size category with the exception of Size Category 3 (5.0 - 9.9 A.). To facilitate comparison, tables grouping properties into small (under 10 A.), medium (10 - 49.9 A.) and large (over 50 A.) categories and averaging within each grouping were constructed (Tables 4.6 and 4.7).

Table 4.6

Average Price/Acre by Size Category - 500 KV Study Area

	500 KV Line	500 KV Control	Line vs. Control
Small (under 10A)			
Frequency	96	141	
Av. Price/A ($)	30,024	42,300	-29.0%
Medium (10-49.9A)			
Frequency	158	104	
Av. Price/A ($)	1,340	1,832	-26.9%
Large (over 50A)			
Frequency	57	70	
Av. Price/A ($)	679	881	-22.9%

A comparison of the figures in Tables 4.6 and 4.7 for each line and its respective control, shows some rather striking findings. Averaged over a large number of sales, the price per acre of properties on the line was consistently lower, ranging between 16.9% and 29.3% lower than control prices. Results were surprisingly consistent between the 500 KV and 230 KV study areas.

Table 4.7

Average Price/Acre by Size Category - 230 KV Study Area

	230 KV Line	230 KV Control	Difference Line vs. Control
Small (under 10A)			
Frequency	61	79	
Av. Price/A ($)	17,554	24,844	-29.3%
Medium (10-49.9A)			
Frequency	85	69	
Av. Price/A ($)	1,236	1,682	-26.5%
Large (over 50A)			
Frequency	48	44	
Av. Price/A ($)	956	1,147	-16.7%

Small properties (under 10 A.) appear to be the most strongly affected by the presence of the line with prices per acre being 29.0% lower on the 500 KV line and 29.3% lower on the 230 KV line than on their respective controls. Medium sized properties (50-99.9A) appear to be almost as strongly affected with prices per acre 26.9% lower on the 500 KV line and 26.5% lower on the 230 KV line. There seems to be less of an effect on larger properties (over 100A) and a greater difference between study areas. Prices per acre were 22.9% lower on the 500 KV line and 16.7% lower on the 230 KV line as compared to their respective controls.

These results are in sharp contrast to the findings of previous studies of this type which found no substantial decrease in value attributable to transmission lines. The number of transactions considered in this study, however, was much larger than in any previous research. This enlarged data base increases the reliability of the finding that transmission lines do, in fact, have a depressing effect on the market value of affected properties. However, before the percentage decreases determined can be accepted as an accurate measure of the actual impact of transmission lines, consideration

must be given to several factors and further analysis must be undertaken. Factors to be considered relate to the assumptions made regarding this analysis.

The analysis undertaken dealing with the physical characteristics of the study areas (Chapter 3) indicated that there was no significant variation in the nature and quality of land between the lines and their respective controls. While this is true at the level of generalization of that analysis, there are likely some variations in inherent land characteristics of specific lots. For example, a particular lot on the control may be a better piece of land than a particular lot on the line and may have a higher value because of this. However, because of the large number of transactions involved and the probability that similar variations in each direction are found in each area, the influence of inherent property characteristics on the difference between average values can be safely ignored.

The analysis in Chapter 3 did, however, show a statistically significant difference between the study areas, with the 500 KV area being of somewhat higher inherent quality. This difference does not appear to be reflected in the average price per acre figures for medium and large size categories (over 10A.). Average prices per acre were slightly higher in the 500 KV area for medium size properties (10-50A) and higher in the 230 KV area for large properties (over 50A). Average prices per acre are, however, much higher in the 500 KV area for small properties (under 10A). Since the price of small, residential properties is more related to factors such as accessibility and level of improvement than inherent capabilities for agriculture or forestry, the difference in market value between the study areas cannot be attributed to the differences of physical character. The higher market value of small properties in the 500 KV study area is more likely related to the

higher general level of development as discussed previously.

The assumption was made that, on the average, improvements made to properties on the lines and controls would be of similar value. This assumption was made because of the large number of properties involved and the impossibility of making a lot by lot assessment of the value of improvements. There is a definite possibility that this assumption cannot be made. It may be that owners of properties on transmission lines are less inclined to make improvements than their counterparts on the controls. The presence of the line may induce them to fear that any investment in improvements would not be recouped in a sale at a later date. The possibility of lower improvement levels might be supported by the finding earlier in this analysis that there were fewer sales of small properties on the lines than on the controls. If this is the case, the value of improvements to properties on the line may be lower, consequently lowering the market value of the properties. Hence, the values of the depreciating effect attributed to the hydro lines (Tables 4.6 and 4.7) may be larger than the actual circumstance dictate. Unfortunately, without a survey of improvements, this possibility cannot be verified.

The effects of inflation were not considered in the analysis. If, in fact, more sales had occurred on the controls in the later years of the time period under consideration and on the line in the early years, inflation might account for part of the difference in value. A visual analysis of the data presented in the summary Appendix Tables IV-1-4, however, does not suggest this.

The nature of the statistical comparisons of average price per acre may also be a factor in the determined level of difference in market values. The figures in Tables 4.6 and 4.7 are based on arithmetic mean (averages) and do not take into account the distribution of the values they average. It is

possible that a few very large values may distort the average to a level that is not truly representative of the majority of the values. However, the consistency of the difference between on-line and control averages for each site category within and between study areas suggests that this is not the case.

In several instances in the above discussion of average price per acre, the similarity of the 500 KV and 230 KV study areas has been noted. While the actual, average prices per acre for different size categories differ between the areas, the differences between lines and controls within each area, expressed in percentages, are comparable. The variation in dollar values may be attributed to factors of location, accessibility, development and improvement levels. The depreciating influence of the presence of a transmission corridor on market values, however, does not appear to be different in the study areas. It might be suggested from this that the impacts of a 500 KV and a 230 KV line on the market value of property are not substantially different. The possible exception to this might be that a 230 KV line has slightly less impact on large properties.

Contrary to the findings of previous research, this study indicates that the market value of property is depressed by the presence of a transmission corridor. The actual measure of the depreciating effect, however, has not been conclusively established by this research. When all the factors discussed above are taken into account, it might be suggested that the calculated effect, ranging from 16 to 29% is somewhat inflated. However, it is felt by the researchers, that even if the magnitude of the depreciating effect has to be lowered by several percent to better reflect reality, the market value of properties affected by transmission lines is significantly lower

than properties at a distance from the line. Properties of all sizes are affected with the impact being most strong on small and medium sized properties. This would indicate that residential estates and hobby farms are more strongly affected than are commercial farms.

Conclusions

The analysis of the frequency and selling price of a large number of real estate transactions allows a number of conclusions to be drawn regarding the impacts of transmission lines on the properties they affect. These conclusions summarize the findings of analysis discussed in the preceding sections.

The presence of a transmission corridor has some effect on the size of properties sold. In the period under analysis, 1967-77, fewer small properties (under 10A) were sold on the lines than on the control. It is suggested therefore, that areas adjacent to transmission corridors are less attractive for development of small properties and subdivisions than areas at a distance from the line. Sales of properties of medium size (50-100A) are not adversely affected by the presence of a line and, possibly, are even encouraged. Large properties (over 100A) are sold with similar frequency in areas affected by a line and areas away from the line. There appears to be no substantial difference in the effects of a 500 KV and 230 KV line on the frequency of sizes of properties sold.

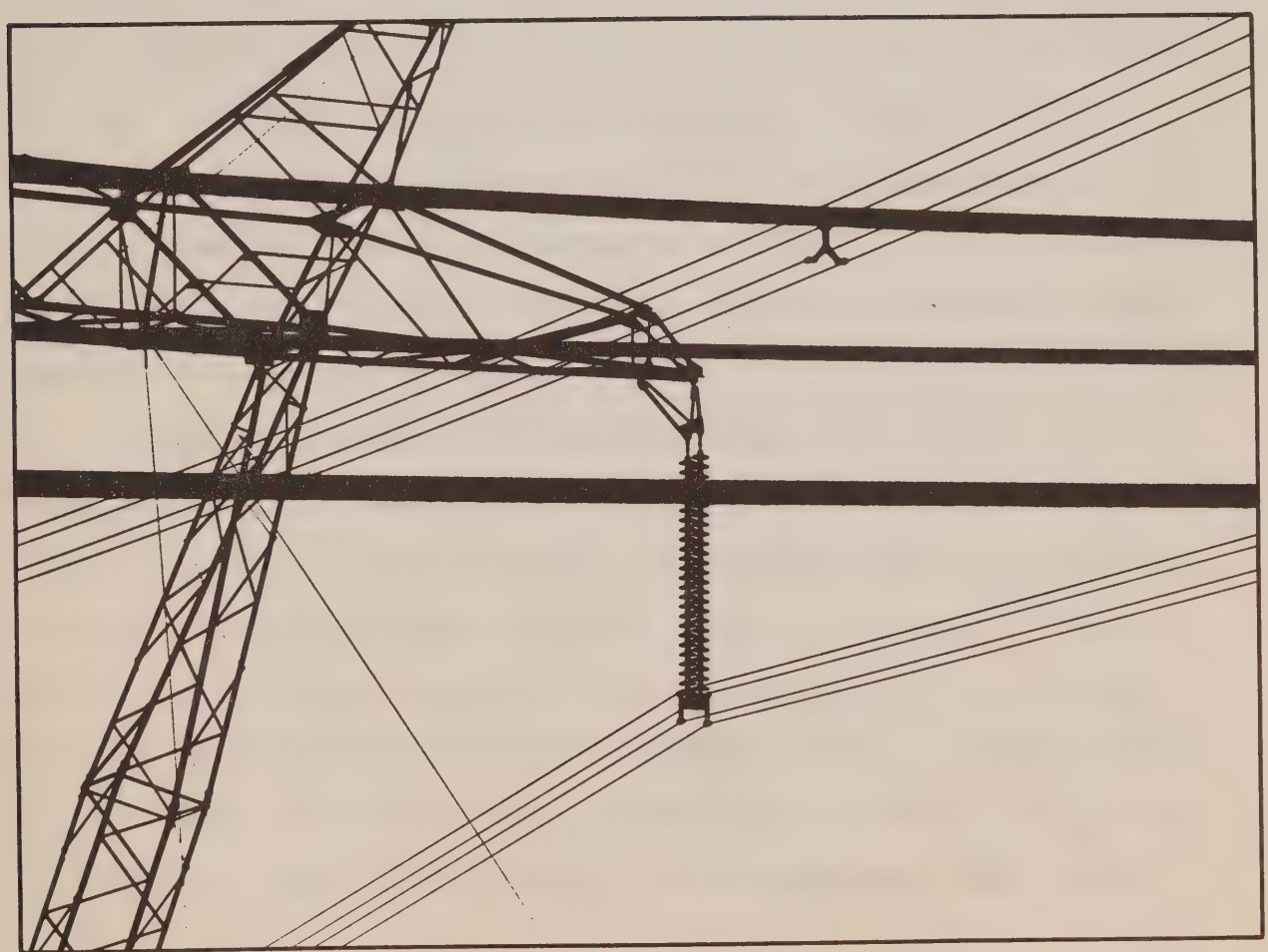
The establishment of a transmission line has an impact on the frequency of sales during the period of land acquisition for the right of way. Sales of property increase during this phase of corridor construction and the impact is seen most strongly among medium sized properties (10-50A). Once the transmission corridor is established, however, the frequency of sales fluctuates

in a pattern similar to the fluctuations of the general activity of the real estate market.

Although transmission corridors do not have strong effects on the frequency with which properties are sold, the research results show that transmission corridors do have a definite and measurable impact on the market value of properties they affect. The analysis of the average price per acre of 1,000 sales of differing size properties shows that the value of affected properties is depreciated by 16.7% to 29.3%. In consideration of a number of factors relating to the assumptions made for analysis and the nature of the statistical comparison, the magnitude of the impact may be slightly inflated. It is concluded therefore, that transmission corridors do in fact, affect property values and that the effect is in the range of 15 to 25%. Properties of smaller size (under 10A) are most affected and the effect lessens with increasing property size. The decreasing impact with increasing property size indicates that the market value of estate residential properties is more strongly affected than is the market value of farm properties. The comparison of the results for the two study areas indicated that the impact of a 500 KV and 230 KV line is similar for small and medium size properties but that a 230 KV line may have slightly less impact than a 500 KV line on the market value of properties over 100 acres.

Chapter 5

Field Research Methodology



Chapter 5 Field Research Methodology

Introduction

The fourth and most extensive phase of the research program for this project was the undertaking of a questionnaire survey. Individuals directly affected by the 500 KV and 230 KV lines and control samples were questioned on their perceptions, attitudes and opinions regarding a number of issues relating to hydro lines and their impacts. This phase of the research was essential to establish the nature of the impacts, how people feel about them and what processes of adjustment and adaptation have taken place since the construction of the line. The use of control groups was important so that the views of those directly affected could be compared to those held by a similar group of individuals, living in a comparable area at a distance from the line. The results of the survey are presented in Chapter 7.

In addition to questioning respondents on their perceptions and attitudes, a number of information questions were included in the questionnaire. The results of these questions were used to construct the community profile presented in the following chapter.

A study of this kind required a high degree of co-operation and co-ordination among the research team. Individual responsibilities such as initial research, questionnaire design, questionnaire distribution and data analysis were delegated equally among the members of the group. Approximately seven months were required to complete this phase of the research. The first three months were spent on preliminary research, design and organization. The next two months were spent on data collection and the final two months were used for data analysis and interpretation. This chapter

will deal with the methods used for the research including questionnaire design, sampling techniques, administration methods, analysis methods and limitations of the methodology.

Questionnaire Design

Relevant issues for inclusion in the questionnaire were identified by the review of previous research and each part of the questionnaire was designed to establish facts or describe perceptions and attitudes regarding one of these issues. The corresponding parts of both the transmission corridor and control questionnaires were designed to establish basically the same things, although from a different point of view. The questionnaire for the transmission corridor was designed to fulfill the objectives of the survey in the context of those people actually affected, while the control questionnaire was designed to elicit the feelings of a group of people not within the immediate impacted area. In an effort to maintain credibility, the same wording was used whenever possible. Thus, the explanation of the questions which follows applies in both contexts. Sample questionnaires are provided in Appendix V. The eight main sections of the questionnaire are as follows:

Part A gave the background information regarding the property of the respondent.

Part B asked the individual about his likes and dislikes of the area in which he dwells, thus obtaining perceived aesthetic values. The questions in Parts A and B were placed at the beginning of the questionnaire, before specific questions regarding hydro lines were asked. This was done to gain some insight of the respondent's sensitivity to the presence of the hydro line in the landscape.

Part C dealt directly with the site of the line and more specifically, the towers. Individuals were asked to draw a rough sketch map of their property showing the hydro towers and other prominent features. These maps easily portrayed the position of the corridor in relation to the respondent's buildings, fields and fences. In addition, a general question asked of the respondent, if the line affected his life in any way.

Part D contained a set of questions dealing directly with the respondent's attitudes toward the presence of the line, its impact on considerations in buying or selling property and its possible implications with respect to property values. A question was asked about the specific property arrangement that Ontario Hydro had with the individual and his feelings about that arrangement.

Part E contained three questions regarding land use around the base of the towers and effects of the towers on farm efficiency.

Part F sought information about the amount of awareness and concern about possible health effects and accidents associated with high voltage transmission lines.

Part G questions were oriented towards gaining the respondent's opinions about the actual physical appearance and prominence of the line. Questions dealing with alternative approaches to new corridors were also asked.

Part H contained standard questions associated with the representative socio-economic indicators for the individual respondent.

Question Response Types

A variety of question types were designed, including closed fixed alternative, yes/no, and open ended questions. An ordinal scale was used in questions requiring accurate opinions of the respondent. In addition, a space was provided below many of the questions to encourage individual comments and explanations.

Sampling Design

To contribute strength to the findings of a study of this kind, it was originally determined that a sample size of 100 respondents from each study area would be ideal. This would have meant that approximately one out of four residents on each line would have been surveyed. Unfortunately, because of time constraints, winter driving hazards and in some cases, lack of response, a sample of the ideal size was not possible to obtain. In actuality, samples about half the size of the ideal were obtained with approximately 50 respondents from each study area. This number was considered the minimum for adequate analysis.

To establish the sample, the researchers approached every fourth house along the study routes. If the householder refused to participate, consecutive houses were approached until a willing respondent was located. On-line and control questionnaires were distributed in a similar manner.

The success rate of questionnaire response was approximately 70%. In total, 108 questionnaires were collected, 28 and 26 from the 500 KV and 230 KV lines and 23 and 31 from their respective control groups.

Administration Methods

Originally, questionnaires were to be completed during a personal interview. This method, however, proved to be too time-consuming and inconvenient for both the interviewer and respondent. The actual task of distributing the questionnaire was completed in teams of two. Upon meeting the resident, interviewers introduced themselves and presented a formal letter from George McCague, Commissioner of the Royal Commission on Electric Power Planning, which explained their purpose. Questionnaires were self-administered, to be completed in a time convenient for the respondent, and were picked up at a later date. A self-addressed envelope and stamp were distributed with each questionnaire to ensure its return to the study group. Questionnaires were left at houses where no one was home along with a letter which explained its purpose, and residents were asked to return the questionnaire by mail.

The task of administering the questionnaires was completed during a period of two months. Winter driving hazards tended to slow the process.

Analysis Methods

The data from the questionnaires was analyzed through the use of the S.P.S.S. (Statistical Package for the Social Sciences) computer system available at the University of Waterloo. Data analysis required that the answers to the questionnaire first be coded. The data input was in computer card format, with the case number represented in columns 1 through 3 and coded values being placed in columns 6 through 80. S.P.S.S. offers a full range of statistical tests which were carried out for the full length of the questionnaire. Such tests include mean, mode and Chi-square analysis. The S.P.S.S. system also offers the option of cross-tabulations. These were used to

compare the results of two or more questions and gave an overview of the relationship between the responses to different questions. Data checks by various individuals reduced the chance of error.

Comments were not coded but were manually assimilated and organized for use in the discussion of analysis.

Limitations of Methodology

As with any study of this size and complexity, a number of limitations in methodology were identified. Some of these were recognized at the outset while others became apparent only in hindsight.

The sample should ideally have been approximately 200, but problems in data collection (i.e. winter driving hazards) lowered this number considerably. A larger sample size would have given larger cell-sizes in cross-tabulations and would have allowed for a deeper analysis. Also, a better distribution of farmers and non-farmers would have allowed for more complete analysis.

This study was designed to test the attitudes of affected land owners. This, in effect, might be deemed as an attempt to describe reality, insofar as it can be successfully described. The study was also designed in an attempt to test the control group's perception of that reality. The goal was to garner some feeling for the adaptive differences between the two groups. In the second aspect, the study was less successful than had been hoped. Control respondents were reluctant to speculate on what the on-line group's attitudes might be. Unfortunately, since the interviews were not personally conducted, but self-administered, it was felt that many control respondents followed 'the path of least resistance' by responding in the 'do not know' and 'no opinion' categories. This, of course, is not to deny that 'do not know'

and 'no opinion' are valid responses. The lack of success in this approach might make it appear to be less desirable than the option of testing only the control's personal opinion, but it is not believed that the possibilities for it should be dismissed lightly.

The control questionnaire was mixed in its request for personal opinions and perceptions of the on-line opinions. Because of the nature of the issues involved, this approach was taken. For issues relating to more abstract aspects, it was felt wise to allow the control respondent to express his own views, while on some of the more concrete issues, it seemed logical to attempt to ascertain the control respondents' perception of the on-line group's feelings. For example, the control group was asked if the appearance of the hydro line bothered them (personal view) but they were asked if hydro towers had an effect on the farm efficiency of the on-line group. The determination of how each question should be approached was not done arbitrarily, but was the result of discussion among the research group members. This mixing of approaches to questions contributed to the problem of non-response discussed above.

Categories of answers were not as consistent as they might have been. The main problem found was an apparently almost random inclusion of 'do not know' and 'no opinion' choices on different questions. This oversight was a result of not expecting such a large proportion of responses to consistently fall into these categories.

Chapter 6

Community Profile of Respondents

Chapter 6 Community Profile of Respondents

Introduction

Prior to the analysis of the perceptions and attitudes expressed by respondents to the questionnaire, it is essential that a community profile of the individuals involved be established. As in the analysis of the physical parameters of the study area (Chapter 3), the social parameters were measured and compared. This analysis and comparison was necessary for the interpretation of responses to the questionnaire and to identify any factors which might contribute to overall patterns of attitudes or adjustment. It was also necessary, for the comparison of results, to identify any factors in the nature of the area, the type of properties or socio-economic variables which may affect the results or explain apparent differences between groups of respondents.

A number of information questions were asked of the respondents to gain an understanding of the residents and types of property within the study area. These questions are found in Parts A and H of the questionnaire (Sample questionnaires are provided in Appendix V). The results of these questions were used to construct the community profile and to make a number of comparisons employing Chi-square tests. Tests were conducted comparing the combined on-line with combined control; each line with its respective control; the 500 line and the 230 line and the 500 control and 230 control. Results for important information questions are provided in tables in this chapter. The results of the Chi-square test corresponding to the tables in the text are summarized in Appendix Table VI-1.

Note: Because of the many repetitions in this and the following chapter the

designation of groups of respondents has been shortened. Respondents on the 500 KV transmission line will be referred to as 500 on-line and similarly in the 230 KV study area, the 230 on-line. Respective control groups are called 500 control and 230 control.

Property Aspects

Property Type

The majority of respondents resided on farm properties with 88.9% of the combined on-line and 66.7% of the combined control living on farms (Table 6.1). The difference between combined on-line and control, however, was significant at the 0.0065 level. While the 500 on-line and control groups showed similar proportions of farms, the 230 on-line and control were quite different with all 230 on-line respondents from farms and 48.7% of 230 control respondents from residential properties. This difference was significant at the 0.0001 level. Comparing 500 on-line and 230 on-line groups, there is

Table 6.1

Property Type

	Comb Line	Comb Control	500 Line	500 Control	230 Line	230 Control
Farm						
Frequency	48	36	22	20	26	16
%	88.9	66.7	78.6	87.0	100.0	51.6
Residential						
Frequency	5	18	5	3	--	15
%	9.3	33.3	17.9	13.0		48.4
Other						
Frequency	1	--	1	--	--	--
%	1.9		3.6			
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

again a significant difference (0.0435 level of significance). Because of the possible effects of this factor, it was necessary to make comparisons of responses by farmers and non-farmers. This comparison will be made towards the end of the following chapter.

Farm Type

Approximately 75% of those respondents who were farm operators indicated that their farms were general or livestock operations (Table 6.2). Responses were similar for all groups. There were few specialized operations (dairy, horse, hobby), but where they were found, they were located in the on-line groups. The type of farm operation could be statistically significant when comparing combined on-line and control responses (significant at the 0.0777 level).

Table 6.2

Farm Type

	Comb Line	Comb Control	500 Line	500 Control	230 Line	230 Control
General						
Frequency	21	18	10	10	11	8
%	46.7	56.3	52.6	50.0	42.3	66.7
Livestock						
Frequency	10	7	2	5	8	2
%	22.2	21.9	10.5	25.0	30.8	16.7
Dairy						
Frequency	9	1	4	1	5	--
%	20.0	3.1	21.1	5.0	19.2	
Horse						
Frequency	3	1	2	1	1	--
%	6.7	3.1	10.5	5.0	3.8	
Hobby & Other						
Frequency	1	5	1	3	1	2
%	2.2	15.6	5.3	15.0	3.8	16.7
Not Applicable						
Frequency	5	17	5	3	--	14
No Answer						
Frequency	4	5	4	--	--	5
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Property Size

As might be expected, there were substantial differences in the size of property owned by respondents (Table 6.3). These differences are clearly related to the differences in the type of property as most residential properties tend to be smaller than farm operations. The difference between combined on-line and control was statistically significant at the 0.0074 level. The on-line respondents reported more medium size properties (50-149.9A) while the control showed more properties in the smaller sizes (1-49.9A). There were few properties in the study area over 150 acres.

Table 6.3

Size of Property

	Comb Line	Comb Control	500 Line	500 Control	230 Line	230 Control
1-9.9A						
Frequency	3	13	3	1	--	12
%	5.7	25.0	10.7	4.3		41.4
10-49.9A						
Frequency	6	11	4	6	2	5
%	11.3	21.2	14.3	26.1	8.0	17.2
50-149.5A						
Frequency	36	19	18	12	18	7
%	67.9	36.5	64.3	52.2	72.0	24.1
150A+						
Frequency	8	5	3	3	5	5
%	15.1	15.4	10.7	13.0	20.0	17.2
Did Not Know						
Frequency	--	1	--	1	--	--
%		1.9		4.3		
No Answer						
Frequency	1	2	--	--	1	2
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Percentage of Property Farmed

The pattern of responses to the question of the percentage of property farmed, again, reflects the differences in the type of property (Table 6.4). While 70.4% of on-line respondents farmed 75-100% of their property, 45.3% of the control farmed a similar proportion. This difference is statistically significant at the 0.0266 level. The larger number of residential properties in the 230 control accounts for the relatively high proportion (50%) of respondents indicating that they farm 0-24% of their property. This is reflected in the statistically significant difference between 230 on-line and control groups (0.0007 level).

Table 6.4

Percentage of Land Farmed

	Comb Line	Comb Control	500 Line	500 Control	230 Line	230 Control
0-24%						
Frequency	6	18	5	3	1	15
%	11.1	34.0	17.9	13.0	3.8	50.0
25-49%						
Frequency	2	2	2	2	--	--
%	3.7	3.8	7.1	8.7		
50-74%						
Frequency	8	9	4	6	4	3
%	14.8	17.0	14.3	26.1	15.4	10.0
75-100%						
Frequency	38	24	17	12	21	12
%	70.4	45.3	60.7	52.2	80.8	40.0
No Answer						
Frequency	--	1	--	--	--	1
Total	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Number of Towers

The on-line groups were asked how many towers were on their property (Table 6.5). The 500 on-line group had a higher percentage with more than five towers than did the 230 on-line group (500 on-line, 40.7%; 230 on-line, 8%). This difference is undoubtedly accounted for by the 500 line having two parallel sets of towers.

Table 6.5

Number of Towers on Property

	Comb Line	500 Line	230 Line
0			
Frequency	13	7	6
%	25.0	25.9	24.0
1-2			
Frequency	19	7	12
%	36.5	25.9	48.0
3-4			
Frequency	7	2	5
%	13.5	7.4	20.0
5+			
Frequency	13	11	2
%	25.0	40.7	8.0
No Answer			
Frequency	2	1	1
Totals	54	28	26
	100.0	100.0	100.0

Socio-Economic Aspects

Sex of Respondents

The majority of all respondents were male and no statistically significant differences were found (Table 6.6).

Table 6.6

Sex of Respondent

	Comb Line	Comb Control	500 Line	500 Control	230 Line	230 Control
Male						
Frequency	33	41	18	18	15	23
%	62.3	75.9	66.7	78.3	57.7	74.2
Female						
Frequency	20	13	9	5	11	8
%	37.7	24.1	33.3	21.7	42.3	25.8
No Answer						
Frequency	1	--	1	--	--	--
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Age of Respondents

The average age of respondents was between 40 and 60 years, with 51.9% of on-line and 49.1% of control respondents in this category (Table 6.7). Few

Table 6.7

Age of Respondents

	Comb Line	Comb Control	500 Line	500 Control	230 Line	230 Control
Less than 21						
Frequency	2	1	1	1	1	--
%	3.8	1.9	3.7	4.3	3.9	
21-39						
Frequency	13	21	5	10	8	11
%	24.5	38.9	18.5	43.5	30.8	35.5
40-60						
Frequency	26	28	15	11	11	17
%	49.1	51.9	55.6	47.8	42.3	54.8
Over 60						
Frequency	12	4	6	1	6	3
%	22.6	7.4	22.2	4.3	23.1	9.7
No Answer						
Frequency	1	--	1	--	--	--
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

respondents were less than 21 years of age. The on-line respondents tended to be older than the control respondents, but the difference was not found to be statistically significant (significant at the 0.1174 level).

Education

The majority of all respondents had secondary school education (Table 6.8). While all of the control groups showed larger percentages with college or university education as compared to their respective on-line groups, no statistically significant differences in education level were found.

Table 6.8

Education Level of Respondents

	Comb Line	Comb Control	500 Line	500 Control	230 Line	230 Control
Elementary						
Frequency	10	6	5	1	5	5
%	20.4	11.5	20.0	4.5	20.8	16.1
Secondary						
Frequency	30	27	15	13	15	14
%	61.2	51.9	60.0	59.1	62.5	46.7
College or Univ.						
Frequency	8	15	4	7	4	8
%	16.3	28.8	16.0	31.8	16.7	26.7
Vocational						
Frequency	1	4	1	1	--	3
%	2.0	7.7	4.0	4.5		10.0
No Answer						
Frequency	5	2	3	1	2	1
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Occupation

The responses to the open-ended question of occupation were coded as either farmer or non-farmer (Table 6.9). As expected, the results correlate with those from the question of property type. Of the combined on-line group

Table 6.9

Occupation of Respondents

	Comb Line	Comb Control	500 Line	500 Control	230 Line	230 Control
Farmer						
Frequency	36	23	14	10	22	13
%	69.2	46.9	53.8	47.6	84.6	41.9
Non-Farmer						
Frequency	16	26	12	11	4	15
%	30.8	53.1	46.2	52.4	15.4	48.4
No Answer						
Frequency	2	5	2	2	--	3
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

69.2% were farm operators as compared to 46.9% of the control respondents. This difference was significant at the 0.0617 level. Stronger differentiation is seen among the 230 respondents with 84.6% of on-line respondents as farmers and only 41.9% of the control respondents being farm operators. In this case, the difference is significant at the 0.008 level. As with the difference in property type, the difference in occupation was considered as a possible factor influencing responses and was accorded further analysis.

Years of Residence

Responses to the question regarding length of residence show that very few respondents had lived in the area less than one year, but about one-third of the respondents had lived there for less than five years (Table 6.10). While the on-line groups showed longer residency, than did the control groups, the difference was not statistically significant (significant at the 0.3616 level). The majority of all respondents (97%) were year-round residents of the area.

Table 6.10

Years of Residence

	Comb Line	Comb Control	500 Line	500 Control	230 Line	230 Control
Less than 1 year						
Frequency	1	3	--	--	1	3
%	1.9	5.6			3.8	9.7
1-5 years						
Frequency	14	20	8	9	6	11
%	25.9	37.0	28.6	39.1	23.1	35.5
6-10 years						
Frequency	7	7	4	4	3	3
%	13.0	13.0	14.3	17.4	11.5	9.7
More than 10 years						
Frequency	32	24	16	10	16	14
%	59.3	44.4	57.1	43.5	61.5	45.2
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Conclusions

The socio-economic background of the respondents with the exception of occupation (i.e. age, sex, education level, and the number of years residence) was similar in all the groups surveyed. There were no significant differences found in this area which might affect the questionnaires results. Therefore the responses of the various groups should be comparable.

There were, however, some statistical differences in the nature of the sample's property. The most significant difference was that 100% of the 230 on-line group owned farm properties whereas the 230 control group included only 51.6% farm properties. This noted difference accounted for some statistically significant differences in the size of the property, the percentage farmed, the type of farm operation, and the occupation of the resident. When analyzing the results of questions pertaining to the properties, these significant differences between groups must be considered.

Chapter 7

Social Impacts of Transmission Corridors

Chapter 7 Social Impacts of Transmission Corridors

Introduction

The program of field research outlined in Chapter 5 resulted in the collection of a large amount of information. The questionnaire generated data of two basic types. Factual and descriptive information was used to develop the community profile presented in the preceding chapter. The largest portion of the questionnaire, however, was designed to fulfill the fourth objective of this study. The respondents were surveyed regarding their perceptions, attitudes and opinions on a number of issues relating to transmission corridors and their impacts. Individuals were asked about their general perceptions of their area, their feelings at the time of construction, and their current opinions. This was done in an attempt to assess the position of the transmission corridor in a broader perspective and over a longer term and to give some insight into the adaptive responses of the individuals. Control groups of respondents were used to gain an understanding of the role of proximity and experience in the formation of perceptions and attitudes and to give further insight into adaptation processes. The results of questions on social impacts are presented in the balance of this chapter.

In the following sections, survey results are organized by subject, roughly corresponding to questionnaire Parts (sample questionnaires are provided in Appendix V). Responses to specific questionnaire items are presented in tables showing results for combined on-line and control groups as well as responses broken down for the 500 KV and 230 KV study areas. Where there were differences in the wording, both on-line and control questions are included in the title of the tables. Absolute frequencies and relative frequencies,

expressed as percentages, are included for all responses. Where there was a high level of 'do not know' and 'no opinion' responses, adjusted relative frequencies are also included. Again, calculations for Chi-square tests of the information presented in the tables is not included in this report but a table summarizing Chi-square levels of significance is provided in Appendix VII. Where relevant, comments written by respondents are included in the discussion.

The analysis of information for the community profile (Chapter 6) showed some significant differences in the occupation and property type within and between groups of respondents. Because the position of the individual as a farm operator or a rural resident was identified as a possible factor affecting responses, a comparison of the responses of farmers and non-farmers was undertaken. The results of this comparison are included at the end of this chapter.

General Perceptions

All respondents were asked about their likes and dislikes of the area in which they live. These open-ended questions were included in an attempt to gain some insight into the residents' general perceptions. The questions preceded all others asking for more specific information on hydro lines.

Things residents liked about their area included a broad range. Mentioned most frequently were location in relation to towns, services and markets, privacy and quiet rural living. The 230 KV on-line group indicated more strongly their appreciation for the quality of land for agriculture. (The entire 230 KV on-line sample listed their occupation as farm operator.)

Things disliked about the area included an equally broad range. Some items mentioned were winter weather, road maintenance and service, abandoned

land and speculators. The presence of the hydro line did not figure significantly in most resident's consideration of what they do not like about their area (Table 7.1). The 500 KV on-line residents and both controls responded similarly with less than 5% stating the existence of the hydro line as one of their dislikes about their area. The 230 KV on-line group was different, with 19.2% of the group stating that the hydro line was a feature they dislike about their area. This difference in response by the 230 KV on-line group is not limited to this question but recurs throughout the questionnaire results.

Table 7.1

Are there things about this area you do not like?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Hydro Lines Stated						
Frequency	6	1	1	1	5	0
%	11.1	1.9	3.6	4.3	19.2	0
Hydro Lines Not Stated						
Frequency	48	53	27	22	21	31
%	88.9	98.1	96.4	95.7	80.8	100.0
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

The combined results show that the on-line group's opinion as to whether the hydro line affects life in any way is almost evenly split (affected, 47.2%; not affected, 50.9%) (Table 7.2). Again, the 230 KV on-line group felt more strongly that the hydro line does affect life than the 500 KV on-line group (230 KV on-line, 57.7%; 500 KV on-line, 37%). The control respondents, expressing a definite opinion, think the line does not affect the on-line residents by a ratio of approximately 2:1. The largest portion of the control group, however, responded in the undecided category. This indicates the unwillingness of the control group to speculate on what the opinion

Table 7.2

Does the hydro line affect your/their life in any way?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Affected						
Frequency	25	9	10	5	15	4
%	47.2	17.0	37.0	21.7	57.7	13.3
Not Affected						
Frequency	27	19	16	7	11	12
%	50.9	35.8	59.3	30.4	42.3	40.0
Undecided						
Frequency	1	25	1	11	--	14
%	1.9	47.2	3.7	47.8		46.7
No Answer						
Frequency	1	1	1	--	--	1
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

of those on the line might be. This, unfortunately, also recurs throughout the questionnaire results.

Opinions at the Time of Construction

The questions relating to opinions at the time of construction are, of course, only applicable to those who lived in the area prior to the construction of the line (Table 7.3).

Table 7.3

Did you live on this property prior to the construction of the hydro line?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Pre Construction						
Frequency	24	19	17	10	7	9
%	44.4	35.2	60.7	43.5	26.9	29.0
Post Construction						
Frequency	30	35	11	13	19	22
%	55.6	68.4	39.3	56.5	73.1	71.0
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Responses show a tendency towards oppositions to construction by on-line residents, while control residents tended to be more favourable (Table 7.4). This may support the findings of previous studies which suggest that hydro lines meet with the greatest amount of opposition during planning and construction phases. There were some extreme responses but a significant portion of both on-line and control groups claimed neutrality on this issue.

Table 7.4

What was your general opinion at the time of construction?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Very Favourable						
Frequency	--	2	--	1	--	1
%		10.5		10.0		11.2
Favourable						
Frequency	3	4	3	2	--	2
%	12.5	21.1	16.7	20.0		22.2
Neutral						
Frequency	9	10	6	4	3	6
%	37.5	56.6	33.3	40.0	50.0	66.7
Opposed						
Frequency	9	2	7	2	2	--
%	37.5	10.5	38.9	20.0	33.3	
Very Opposed						
Frequency	2	--	2	--	--	--
%	4.2		11.1			
No Opinion						
Frequency	1	1	--	1	1	--
%	2.1	5.3		10.0	16.7	
Not Applicable	30	35	10	13	20	22
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

The control was asked their perception of the opinion of the on-line group at the time of construction (Table 7.5). Again, the largest portion claimed they did not know. Of those giving a definite response (i.e. excluding 'do not know'), 54.4% thought on-line residents were favourable or very

Table 7.5

What was the general opinion of the people on the line at the time of construction?

	Comb. Control	500 Control	230 Control
Very Favourable			
Frequency	1	--	1
%	5.3		11.1
Adj. %	9.1		16.7
Favourable			
Frequency	5	2	3
%	26.3	20.0	11.1
Adj. %	45.5	40.0	50.0
Neutral			
Frequency	3	1	2
%	15.8	10.0	22.2
Adj. %	27.3	20.0	33.3
Opposed			
Frequency	2	--	--
%	10.5		
Adj. %	18.1		
Did Not Know			
Frequency	8	5	3
%	42.1	50.0	33.3
Not Applicable			
Frequency	35	13	22
Totals	54	23	31
	100.0	100.0	100.0

favourable at the time of construction while 18.1% thought on-line residents were opposed or very opposed. The control group's own opinions and their perceived on-line opinions were similar. However, both of these opinions were somewhat more positive than the actual on-line opinion.

The 500 KV on-line and control were asked their opinions at the time the second parallel line was constructed (Table 7.6). Significantly, the structure of on-line responses is almost identical to responses to the question asking their opinion of the first line construction (Table 7.4). This suggests that the existence of the first line did not significantly influence their

Table 7.6

On-Line: What was your general opinion of the construction of the second line?
Control: What was the general opinion of the people on the line at the time of construction of the second parallel line?

	500 Line	500 Control
Favourable		
Frequency	3	2
%	16.7	20.0
Neutral		
Frequency	6	1
%	33.3	10.0
Opposed		
Frequency	6	--
%	33.3	
Very Opposed		
Frequency	2	1
%	11.6	10.0
No Opinion		
Frequency	1	--
%	5.6	
Did Not Know		
Frequency	--	6
%		60.0
Not Applicable		
Frequency	10	13
Totals	28	23
	100.0	100.0

attitudes to the second line. It must be noted, however, that during the planning phase of the first line, residents were informed that a second line was forthcoming. Comments with this question include "got used to it", "since there was one line already, another one would not make much difference", and "good to have it parallel". Comments of this nature may indicate possible elements of adjustment. The responses to the corresponding control question were too few to make a comparison.

Effects of Hydro Lines on Real Estate Transactions

Considerations in Decisions to Buy and Sell Property

The question regarding the presence of the line as a consideration in the decision to purchase property was applicable to all control respondents and on-line respondents who purchased their property after the line was constructed (Table 7.7). The on-line group was evenly distributed in that 44.4% viewed the line as a consideration or strong consideration in purchasing their property while 40.7% said it was little or no consideration. In contrast, 78.4%

Table 7.7

On-Line: When you bought the property was the presence of the hydro line in your decision?
Control: Would the presence of a hydro line be a consideration in your decision to purchase property?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Strong Consideration						
Frequency	6	27	2	11	4	16
%	22.2	52.9	22.2	52.4	22.2	53.3
Consideration						
Frequency	6	13	1	4	5	9
%	22.2	25.5	11.1	19.0	27.8	30.0
Neutral						
Frequency	3	2	--	--	3	2
%	11.1	3.2			16.7	6.7
Little Consideration						
Frequency	4	4	2	3	2	1
%	14.8	7.8	22.2	14.3	11.1	3.3
No Consideration						
Frequency	7	5	4	3	2	3
%	25.9	9.8	44.4	14.3	11.1	6.7
No Opinion						
Frequency	1	--	--	--	1	--
%	3.7				3.7	
Not Applicable						
Frequency	27	3	17	2	8	1
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

of the control thought that the presence of a hydro line would be a consideration or strong consideration in a decision to purchase property with 52.9% indicating that it would be a strong consideration. Chi-square tests show this to be a significant difference at the 0.0468 significance level.

Comments from the on-line residents include: "not a dominant feature when we bought the land"; "the presence of the towers outweighed by proximity to Orangeville" and concerns relating to development. Control comments included: "would investigate...the frequency of Hydro's access to the land"; "if I couldn't see the tower I would consider buying it"; "Affects the market value of residential homes moreso than farms" and "would not buy property with towers".

The majority of responses (87.8% of on-line) indicates that the hydro line has not itself caused many landowners to consider selling their property (Table 7.8).

Table 7.8

On-Line: Have you ever considered selling your property because of the hydro line?

	Comb. Line	500 Line	230 Line
Yes			
Frequency	6	2	4
%	12.2	8.0	16.7
No			
Frequency	43	23	20
%	87.7	92.0	83.3
No Answer			
Frequency	5	3	2
Totals	54	28	26
	100.0	100.0	100.0

The responses to these questions would indicate that hydro lines are a factor in objectively considering the purchase of property. However, in an actual decision to buy or sell, the presence of a line may be less of a consideration. This may indicate a trade-off between economic and other considerations. Ideally, the presence of a line would be considered but practical economics dictate otherwise. This is supported by comments and the fact that the majority of respondents had not considered selling their property because of the line.

Effect on Property Values

The majority of all respondents stating a definite opinion, indicated that property values would be adversely affected (on-line, 73.9%; control, 79.3%) (Table 7.9). It should be noted, however, that 45.3% of the control responded 'do not know' indicating a relatively high level of uncertainty on this issue.

Table 7.9

On-Line: Do you feel the hydro line affects the value of this property
Control: Does the hydro line affect the value of their property?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Yes						
Frequency	34	23	18	11	16	12
%	69.4	43.4	75.0	47.8	64.0	40.0
Adj. %	73.9	79.3	81.8	91.6	66.6	70.6
No						
Frequency	12	6	4	1	8	5
%	24.5	11.3	16.7	4.3	32.0	16.7
Adj. %	26.1	20.7	18.2	8.3	33.3	29.4
Do Not Know						
Frequency	3	24	2	11	1	13
%	6.1	45.3	8.3	47.8	4.0	43.3
No Answer						
Frequency	5	1	4		1	1
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Comparing the on-line groups with their respective controls, excluding 'do not know' responses shows no great difference. The 500 KV on-line group, in comparison to the 230 KV on-line group, shows a higher percentage of 500 KV on-line residents feeling that property values are affected (500 KV on-line, 81.8%; 230 KV on-line, 66.6%). Chi-square tests, however, shos this difference is significant only at the 0.4049 level, reducing the probability that this difference is actually significant. Similarly, the 500 KV control group was stronger in its opinion that values are affected than was the 230 KV control (500 KV control, 91.7%; 230 KV control, 70.6%). The difference in strength of opinion between 500 KV and 230 KV respondents may indicate that transmission lines have a varying effect on perceived property values dependent upon the characteristics of the transmission corridor and the nature of the properties affected.

A large majority of those thinking property values are affected, felt values decreased. Very few respondents (both on-line and control) indicated by what percentage they thought values decreased, revealing a large degree of uncertainty regarding the extent to which property values are affected.

On-Line Residents Relations with Ontario Hydro

Combined results show that similar percentages of residents are satisfied and unsatisfied over settlements with Ontario Hydro (25.7% satisfied, 33.3% unsatisfied) (Table 7.10). A majority (74.1%) of the control replied they did not know how satisfied on-line residents were. Chi-square tests indicate that opinionated control response is not significantly different from on-line response.

The 230 KV on-line group appeared to be less satisfied (44.4% not satisfied or very unsatisfied) with property settlements than were the 500 KV on-line

Table 7.10

On-Line: How satisfied are you with this (property) arrangement?
Control: Are the people on the line satisfied with their land dealings with Hydro?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Satisfied						
Frequency	9	6	6	2	3	4
%	25.7	11.3	35.3	8.7	16.7	13.3
Adj. %	31.0	46.2	40.0	40.0	21.4	57.1
Neutral						
Frequency	8	3	5	1	3	2
%	22.9	5.7	29.4	4.3	16.7	6.7
Adj. %	27.6	23.1	33.3	20.0	21.4	28.6
Not Satisfied						
Frequency	10	4	3	2	7	1
%	28.6	7.6	17.6	8.7	38.9	3.3
Adj. %	34.5	30.8	20.0	40.0	50.0	14.3
Very Unsatisfied						
Frequency	2	--	1	--	1	--
%	5.7		5.9		5.6	
Adj. %	6.9		6.7		7.1	
No Opinion						
Frequency	6	1	2	--	4	1
%	17.1	1.9	11.8		22.0	3.3
Did Not Know						
Frequency	--	40	--	18	--	22
%		74.1		78.3		73.3
Not Applicable						
Frequency	19	1	11	--	8	1
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

group (23.5% not satisfied or very unsatisfied). This difference could possibly be explained by improvements in Ontario Hydro's land acquisition policies during the years between the construction of the lines. Chi-square tests show this difference is not statistically significant.

The large majority of the combined on-line respondents (84.3%) have had no complaints or personal conflicts with Hydro regarding the line (Table 7.11). Of the 500 KV on-line group 23.1% have had complaints or personal

Table 7.11

On-Line: Since you have lived here have you had any complaints or personal conflicts with Hydro over the line?

	Comb. Line	500 Line	230 Line
Yes			
Frequency	8	6	2
%	15.7	23.1	8.0
No			
Frequency	43	20	23
%	84.3	76.9	92.0
No Answer			
Frequency	3	2	1
Totals	54	28	26
	100.0	100.0	100.0

conflicts with hydro as compared to 8% of the 230 KV on-line group. However, Chi-square tests show this difference is significant only at the 0.2983 level.

Land-use and Farm Efficiency

On the issue of farm efficiency, comparing the combined control and on-line groups, the major difference is, again, a larger percentage of the control (42.3%) responded in the 'do not know' category as compared to only 8% of the on-line group. This reflects the on-line group's more direct experience with a hydro line and the control's inability (or unwillingness) to give a definite response. Including only those responding definitely (excluding 'do not know' responses) shows 76.6% of the opinionated control group and 58.7% of on-line residents thinking farming efficiency is affected. Chi-square tests show this difference to significant at the 0.0001 level. This difference in opinion may, again, suggest elements of adaptation by on-line residents.

When asked if there might be any difference in land use if the line was not there, again, the major feature to be noted is the high percentage

Table 7.12

On-Line: Have the tower(s) affected your farming efficiency?
Control: Do the hydro towers affect their fram efficiency?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Yes						
Frequency	27	23	14	12	13	11
%	54.0	44.2	56.0	54.5	52.0	36.7
Adj. %	58.7	76.7	60.9	85.7	56.5	68.8
No						
Frequency	19	7	9	2	10	5
%	38.0	13.5	36.0	9.1	40.0	16.7
Adj. %	41.3	23.3	39.1	14.2	43.5	31.3
Do Not Know						
Frequency	4	22	2	8	2	14
%	8.0	42.3	8.0	36.4	8.0	46.7
No Answer						
Frequency	4	2	3	1	1	1
Totals	54	54	28	23	26	31

Table 7.13

On-Line: Would you do anything different with the land if the line wasn't there?
Control: Might they do anything different with the land if the line wasn't there?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Yes						
Frequency	18	8	8	4	10	4
%	36.0	15.4	30.8	18.2	41.7	13.3
Adj. %	39.1	36.4	34.8	44.4	43.4	30.8
No						
Frequency	28	14	15	5	13	9
%	56.0	26.9	57.7	22.7	54.2	30.0
Adj. %	60.9	63.6	65.2	55.6	56.5	69.2
Do Not Know						
Frequency	4	30	3	13	1	17
%	8.0	57.7	11.5	59.1	4.2	56.7
No Answer						
Frequency	4	2	2	1	2	1
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

(57.7%) of 'do not know' responses from the control as compared to the on-line group (8%) (Table 7.13). Excluding the 'do not know' category the response structure is similar between the control and on-line groups, with approximately two-thirds of all respondents stating that land use would not be different.

Sample responses to this questionnaire section may suggest that the types of farm operations in this study are not severely affected by hydro transmission lines. A large proportion of the farms in the study area are mixed or livestock operations which, by nature, are quite flexible. Hence, adaptation may be the result of modification of farming practices in affected areas following construction.

Health Effects

The majority of respondents, both on-line and control, were not aware of any controversy concerning health effects associated with high voltage transmission lines (Table 7.14). However, the 230 KV on-line group appears more aware (47.8%) than the 500 KV on-line and both control groups. Chi-square tests indicate this is a significant difference only at the 0.3935 level.

The combined on-line group shows a trend towards concern on the issue of possible health effects with 58.6% concerned or very concerned and 31.8% not concerned or not concerned at all (Table 7.15). A majority (67.3%) of the combined control did not indicate what they felt the level of concern by on-line residents might be. Excluding 'do not know' responses, Chi-square tests show a significant difference between the opinionated control and on-line groups at the 0.2423 significance level with the on-line respondents showing greater concern.

Table 7.14

In recent years a number of studies have been done concerning the possible health effects of high voltage transmission lines. Most of the studies were inconclusive. Are you aware of any controversy?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Yes						
Frequency	17	16	6	7	11	9
%	34.7	32.0	23.1	31.8	47.8	32.1
No						
Frequency	32	34	20	15	12	19
%	65.3	68.0	76.9	61.2	52.2	67.9
No Answer						
Frequency	5	4	2	1	3	3
Totals	54	54	28	23	26	31

The 500 KV on-line group response is evenly distributed between concerned and not concerned while the 230 KV on-line group indicated higher concern (66.7% very concerned or concerned). A Chi-square test shows this difference significant at the 0.0486 level.

The relatively low level of awareness of health effects, contrasted with the relatively high level of concern, may reflect the controversial nature of this issue.

Safety Considerations

A large majority in the combined control stated that they were not aware of any accidents relating to the hydro line (Table 7.16). Similarly, a large majority of on-line residents indicated they have had no accidents directly related to the hydro line. Of those reporting accidents, eight involved machinery, five involved minor shocks, four involved lightning and one involved livestock. Unfortunately, details of the exact nature of these accidents were not available. Comments to this and other related questions

Table 7.15

On-Line: Are you concerned about the possible (health) effects?
Control: How concerned are the people on the line about the possible (health) effects?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Very Concerned						
Frequency	10	--	4	--	6	--
%	22.7		17.4		28.6	
Adj. %	25.0		18.2		33.3	
Concerned						
Frequency	15	6	7	4	8	2
%	34.1	12.2	30.4	21.1	38.1	6.7
Adj. %	37.5	40.0	31.8	57.1	44.4	25.0
Neutral						
Frequency	1	2	--	1	1	1
%	2.3	4.1		5.3	4.8	3.3
Adj. %	2.5	13.3		14.3	5.6	12.5
Not Concerned						
Frequency	10	5	9	1	1	4
%	22.7	10.2	39.1	5.3	4.8	13.3
Adj. %	25.0	33.3	40.9	14.3	5.6	50.0
Not Concerned at all						
Frequency	4	2	2	1	2	1
%	9.1	4.1	8.7	5.3	9.5	3.3
Adj. %	10.0	13.3	9.0	14.3	11.1	12.5
No Opinion						
Frequency	4	1	1	1	3	--
%	9.1	2.0	4.3	5.3	14.3	
Do Not Know						
Frequency	--	33	--	11	--	22
%		67.3		57.9		73.3
No Answer						
Frequency	10	5	5	4	5	1
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

indicated that farmers are concerned (and sometimes annoyed) about safety hazards and farming efficiency effects of hydro lines.

All groups were asked if they had attended Ontario Hydro's Safety Demonstration at Essa. It should be noted that no direct solicitation has been made by Ontario Hydro to encourage attendance at Essa by 230 KV on-line

Table 7.16

On-Line: Have you had any accidents on your property that were related to the hydro line?
Control: Are you aware of any accidents that were directly related to hydro lines?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Yes						
Frequency	5	5	3	1	2	4
%	9.3	9.4	10.7	4.5	7.7	12.9
No						
Frequency	49	48	25	21	24	27
%	90.7	90.6	89.3	95.1	92.3	87.1
No Answer						
Frequency	--	1	--	1	--	--
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

residents. According to Ontario Hydro, the residents on the 500 KV line have been contacted and encouraged to attend. Of 28 respondents from the 500 KV line, only 3 had attended Essa, and 2 had heard of it but had not attended.

Aesthetic Aspects

In all samples the largest percentage of respondents indicated that the line is, in their own view, prominent or very prominent (Table 7.17). The combined control and on-line results are significantly different (at the 0.0290 significance level) with the control thinking (personal opinion) the line was more prominent. The difference between the 500 KV on-line and control group was significant (at the 0.1258 level), again with the control expressing a higher level of prominence. Similarly, the difference between the 230 KV on-line and 230 control is significant at the 0.1159 level. The two on-line groups were not significantly different. It is interesting to note

Table 7.17

Landscape features assume different prominence in peoples' minds. (You can't see the forest for the trees!) What position does the hydro line assume in yours?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Very Prominent						
Frequency	15	10	7	3	8	7
%	30.0	19.2	29.2	13.0	30.8	24.1
Prominent						
Frequency	9	20	5	12	4	8
%	18.0	38.5	20.8	52.2	15.4	27.6
Neutral						
Frequency	6	13	3	4	3	9
%	12.0	25.0	12.5	17.4	11.5	31.0
Not Prominent						
Frequency	9	3	5	1	4	2
%	18.0	5.8	20.8	4.3	15.4	6.9
Not Prominent at all						
Frequency	4	3	3	1	1	2
%	8.0	5.8	12.5	4.3	3.8	6.9
No Opinion						
Frequency	7	3	1	2	6	1
%	14.0	5.8	4.2	8.7	23.1	3.4
No Answer						
Frequency	4	2	4	--	--	2
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

that the control groups find the line a more prominent feature than on-line respondents who are in closer proximity to the line. This, again, may suggest adaptation by the on-line respondents.

The control group was asked what they thought the prominence of the line in the minds of on-line residents might be (Table 7.18). Again, the largest portion of the sample responded in the 'no opinion' and 'do not know' categories. Of the control group responding, the concensus was that the opinions of the on-line residents was similar to their own.

Table 7.18

Control: What is the position in the minds of the people on the line?

	Comb. Control	500 Control	230 Control
Very Prominent			
Frequency	6	2	4
%	14.0	11.8	15.4
Adj. %	30.0	33.3	28.6
Prominent			
Frequency	6	3	3
%	14.0	17.6	11.5
Adj. %	30.0	50.0	21.4
Neutral			
Frequency	4	1	3
%	9.3	5.9	11.5
Adj. %	20.0	16.7	21.4
Not Prominent			
Frequency	3	--	3
%	7.0		11.5
Adj. %	15.0		21.4
Not Prominent at all			
Frequency	1	--	1
%	2.3		3.8
Adj. %	5.0		7.1
No Opinion			
Frequency	20	10	10
%	46.5	58.8	38.5
Do Not Know			
Frequency	3	1	2
%	7.0	5.9	7.7
No Answer			
Frequency	11	6	5
Totals	54	23	31
	100.0	100.0	100.0

In all samples the distribution of response regarding the appearance of the line is similar (Table 7.19). More people responded that the appearance of the line did not bother them by a ratio of approximately 2:1. This suggests that while the line is perceived as a relatively prominent landscape feature, it is not necessarily viewed negatively.

Table 7.19

Does the appearance of the hydro line bother you?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Yes						
Frequency	18	20	8	9	10	11
%	36.0	37.7	32.0	40.9	40.0	35.0
No						
Frequency	32	33	17	13	15	20
%	64.0	62.3	68.0	59.1	60.0	64.5
No Answer						
Frequency	4	1	3	1	1	--
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Future Planning Aspects

Response indicates that a slight majority of on-line residents (55.1%) feel an increase in voltage would not alter their opinion of the line (Table 7.20). The majority of the control (70.6%) did not know if the on-line residents opinions would be different. Of those responding in a definite manner, the majority (86%) felt that on-line opinion would not be altered by a change in voltage.

Comments relating to this question generally expressed concerns for health and safety factors attendant with a voltage increase, and a desire to have more information on this matter.

The results of the previous question must be considered in the light of the question asking the voltage of the line (Table 7.21). Since a minority of respondents from all samples correctly identified the voltage of the line they lived on or near, it might be inferred that the base upon which opinions are formed is something other than voltage or technical awareness.

Table 7.20

If the voltage carried by the line were different would any of your/their opinions be different?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Yes						
Frequency	6	2	2	1	4	1
%	12.2	3.9	8.0	4.5	16.7	3.4
Adj. %	18.2	13.3	11.8	14.3	25.0	12.5
No						
Frequency	27	13	15	6	12	7
%	55.1	25.5	60.0	27.3	50.0	24.1
Adj. %	81.8	86.7	82.2	85.7	75.0	87.5
Do Not Know						
Frequency	16	36	8	15	8	21
%	32.7	70.6	32.0	68.2	33.3	72.4
No Answer						
Frequency	5	3	3	1	2	2
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Table 7.21

On-Line: Is the line on your property a 230 KV or a 500 KV line?
Control: Is the line to the west of your property a 230 KV or a 500 KV line?

	500 Line	500 Control	230 Line	230 Control
Correctly Identified				
Frequency	12	3	6	3
%	42.9	13.6	28.6	10.7
Not Correctly Identified				
Frequency	--	1	4	2
%		4.5	19.0	7.1
Do Not Know				
Frequency	16	18	11	23
%	57.1	81.8	52.4	82.1
No Answer				
Frequency	--	1	5	3
Totals	28	23	26	31
	100.0	100.0	100.0	100.0

Considering the effects of physical size on opinions, the main difference between the on-line and control groups is the preponderance of 'do not know' responses by the control group (Table 7.22). The majority of on-line residents stating a definite opinion indicated that their opinions would not be changed if the physical size of the line was different. Of the few control respondents expressing a definite opinion, a higher percentage felt that opinions would be different. This was found not to be a statistically significant difference, but was based on few responses. Considering only the on-line groups it appears that physical line size is a stronger factor affecting opinions than is voltage.

Table 7.22

If the physical size of the line were different would your/their opinions be different?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Yes						
Frequency	15	6	8	3	4	3
%	31.3	11.8	29.6	14.3	16.7	10.0
Adj. %	41.7	60.0	40.0	60.0	25.0	60.0
No						
Frequency	21	4	12	2	12	2
%	43.8	7.8	44.4	9.5	50.0	6.7
Adj. %	58.3	40.0	60.0	40.0	75.0	40.0
Do Not Know						
Frequency	12	41	7	16	8	25
%	25.0	80.4	25.9	76.2	33.3	83.3
No Answer						
Frequency	6	3	1	2	2	1
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

Response shows the preferred option by on-line residents for any increase in transmission capacity was taller lines, followed by new corridors and parallel towers (Table 7.23). Chi-square tests show the opinionated

Table 7.23

If it were necessary to increase the hydro capacity through this area, which of the following would you/the people on the line prefer?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
New Corridor						
Frequency	14	2	8	1	6	1
%	28.0	4.8	30.8	4.8	25.0	4.8
Adj. %	28.0	6.9	30.8	6.7	25.0	7.1
Parallel Towers						
Frequency	8	7	5	5	3	2
%	16.0	16.7	19.2	23.8	12.5	9.5
Adj. %	16.0	24.1	19.2	33.3	12.5	14.3
Taller Towers						
Frequency	22	18	12	8	10	10
%	44.0	42.9	46.2	38.1	41.7	47.6
Adj. %	44.0	62.1	46.2	53.3	41.7	71.4
Other						
Frequency	6	2	1	1	5	1
%	12.0	4.9	3.8	4.8	20.8	4.8
Adj. %	12.0	6.9	3.8	6.7	20.8	7.1
Do Not Know						
Frequency	--	13	--	6	--	10
%		31.0		28.6		33.3
No Answer						
Frequency	4	12	2	2	2	7
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

control response is significantly different at the .0965 level. This difference is attributable to a preference for new corridors by on-line residents and a greater preference for taller or parallel towers by control groups. Comments indicate there would be opposition to any increase in facilities, especially if further loss of agricultural land would result.

Opposition to new lines in agricultural areas runs high in both on-line and control groups (Table 7.24). The opposition, however, was stronger among the on-line group with 69.8% opposed or very opposed while the control

Table 7.24

Which of the following best describes your feelings about the construction of new lines in agricultural areas?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Very Favourable						
Frequency	--	2	--	--	--	2
%		3.8				6.7
Favourable						
Frequency	3	2	3	1	--	1
%	5.7	3.8	11.1	4.5		3.2
Neutral						
Frequency	10	19	6	9	4	10
%	18.9	35.8	22.2	40.9	15.4	32.3
Opposed						
Frequency	16	15	10	7	6	8
%	30.2	28.3	37.0	31.8	23.1	28.8
Very Opposed						
Frequency	21	12	7	4	14	8
%	39.6	22.6	25.9	18.2	53.8	25.8
No Opinion						
Frequency	3	3	1	1	2	2
%	5.7	5.7	3.7	4.5	7.7	6.5
No Answer						
Frequency	1	1	1	1	--	--
Totals	54	54	28	23	26	31

group was 50.9% opposed or very opposed. A Chi-square test showed this difference to be significant only at the 0.1873 level. The 230 KV on-line group appears stronger in its opposition than the 500 KV on-line group with the difference statistically significant at the 0.1333 level.

A majority of all respondents who expressed an opinion were in favour of multi-service corridors but support was higher among control respondents (Table 7.25). The difference between on-line and control groups is statistically significant at the 0.0055 level. An interesting finding is that, of the on-line group, 29.2% were not in favour and 29.2% did not know. This is compared to the control group where 9.4% were not in favour and 17% responded

Table 7.25

It has been suggested that larger corridors of land might be used to carry hydro, natural gas and water supplies.

Are you in favour of multi-service corridors?

	Comb. Line	Comb. Control	500 Line	500 Control	230 Line	230 Control
Yes						
Frequency	20	39	10	16	10	23
%	41.7	73.6	43.5	72.7	40.0	74.2
Adj. %	58.8	88.6	62.5	88.9	55.6	88.5
No						
Frequency	14	5	6	2	8	3
%	29.2	9.4	26.1	9.1	32.0	9.7
Adj. %	41.2	11.4	37.5	11.1	44.4	11.5
Do Not Know						
Frequency	14	9	7	4	7	5
%	29.2	17.0	30.4	18.2	28.0	16.1
No Answer						
Frequency	6	1	5	1	1	--
Totals	54	54	28	23	26	31
	100.0	100.0	100.0	100.0	100.0	100.0

'do not know'. This is the only question in the survey for which the on-line group's 'do not know' response was higher than the control group's. This possibly indicates a greater sensitivity in the on-line group to the potential disruption created by multi-service corridors.

Farmer-Rural Resident Comparison

As indicated in the introduction to this chapter, residence type and occupation were identified as possible factors affecting responses. In order to determine the existence and nature of the effect, responses by farmers and non-farmers to all questions were compared. Comparisons were made for farmers and non-farmers for the total sample, farmers and non-farmers for the combined lines and for the combined controls. Because few differences were found, tables of the responses are not included in this report. A table summarizing Chi-

square levels of significance for tests of relevant questions is provided in Appendix VII.

Regarding the majority of issues, there were no signficant differences between the responses of farmers and non-farmers. The on-line farmers, however, tended to differ somewhat from other respondents on several issues. These differences are summarized as follows:

a) On-line farmers tend more to think life is affected than on-line non-farmers. Chi-square tests show this difference to be significant at the 0.2445 level. Responses by farmers on the control lines were similar to responses from control non-farmers.

b) Most landowners have not considered selling their property because of the line. Of the seven that have made such a consideration, six were farm operators.

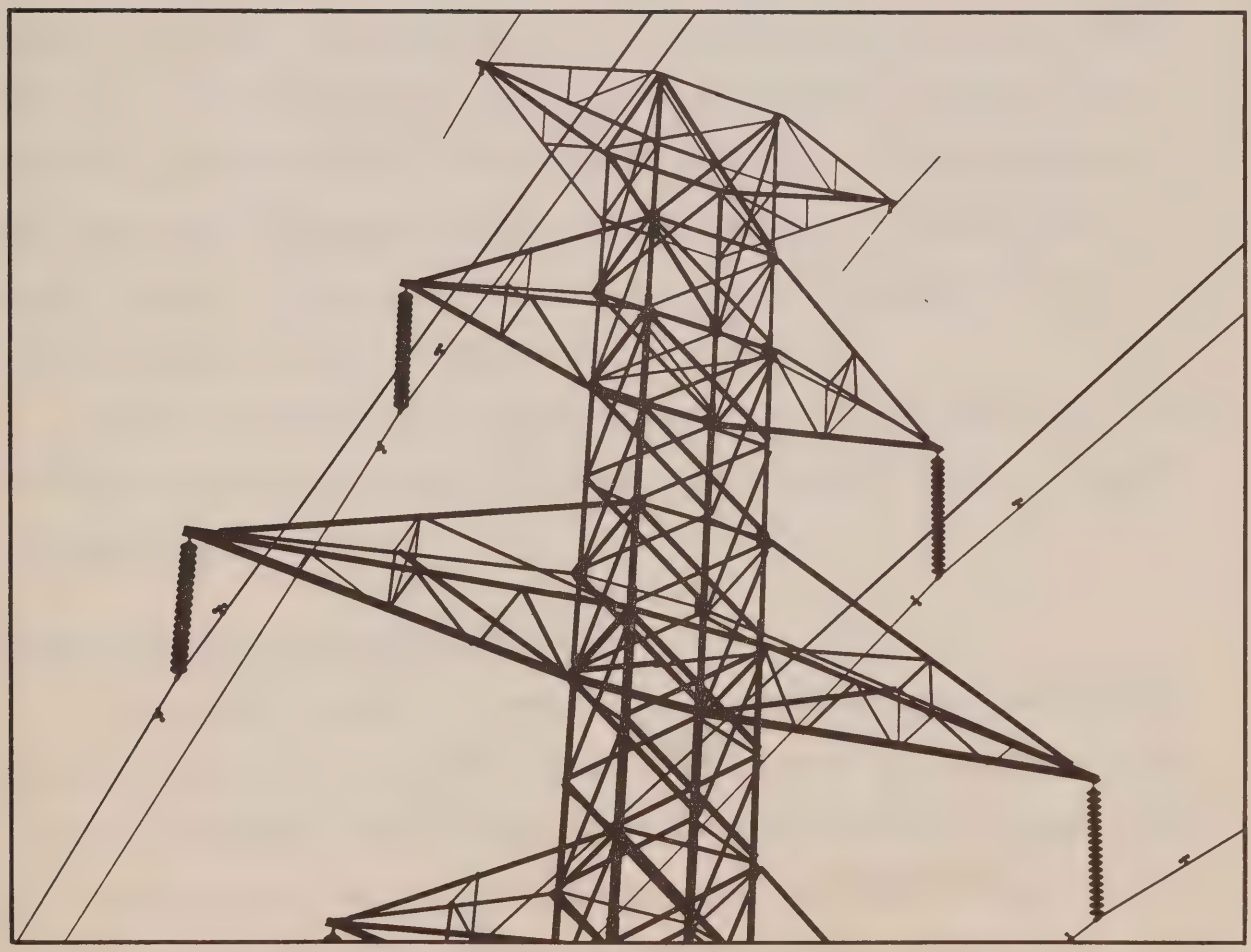
c) On-line farmers tend more than non-farmers (significant at the 0.1101 level) to think they might use their land differently if the line was not there. Opinion among the farm operators however, was evenly divided between yes and no.

d) Opposition to the construction of new lines in agricultural areas was high among all groups. On-line farmers, however, are more opposed than non-farmers. Chi-square tests show this difference to be significant at the 0.0804 level.

It is suggested that the on-line farmers' direct working experience with hydro towers might be responsible for these differences. Because there were relatively few differences, and only in the opposition to the construction of new line was the difference statistically significant, it is suggested that the role of the individual as a farm operator or rural resident does not have a strong influence on the formation of perceptions and attitudes.

Chapter 8

Summary and Conclusions



Chapter 8 Summary and Conclusions

Introduction

In the preceding chapter dealing with the social impacts of transmission corridors, a number of issues were considered and many comparisons between groups of respondents were drawn. Because of the amount of information involved, the major differences between groups on the various issues will be summarized prior to the drawing of conclusions. Two areas of comparison are essential to the objectives of this research project. The first of these is the comparison of the responses by individuals who reside on properties directly affected by the line with the responses for those of the control who live in a similar area but are not directly affected by the presence of the line. The importance of this comparison was discussed in the introduction to the preceding chapter. The second major comparison was between the 500 KV study area and the 230 KV study area. This comparison was undertaken to determine whether the age, voltage and physical size of a hydro line have a bearing on the social and economic impacts and the formation of perceptions and attitudes.

In the summaries which follow only the statistically significant differences or trends are noted. The groups were considered similar in their feelings on other issues.

Summary Comparison - On-Line and Control

Differences between the combined on-line and control groups were statistically significant or tended towards difference on the following issues:

a) The opinionated control tended to be different (at the 0.2 significance level) from the on-line group in being less inclined to think the hydro line has an effect on life (Table 7.2).

b) The opinionated control tended to be more favourable at the time of construction of the line than the on-line group (significant at the 0.1466 level) (Table 7.4).

These tendencies toward more positive attitudes are seemingly inconsistent with the following findings:

c) The control group is statistically different (at the 0.0468 level) from the on-line group in perceiving the hydro line to be a stronger consideration in the decision to purchase property (Table 7.7).

d) The control is significantly different (at the 0.0290 level) in viewing the line as a more prominent landscape feature (Table 7.17).

e) The opinionated control group is statistically different (at the 0.001 level) from the on-line group in thinking that farm efficiency is affected. However, it must be noted that the difference between on-line farmers and opinionated control farmers is significant only at the 0.2 level (Table 7.12).

There were differences between the on-line and control responses regarding considerations for future planning. These differences are summarized as follows:

a) The on-line group prefer the option of new corridors more than the control group (Table 7.23).

b) The opinionated control group tends to be less opposed to the construction of new lines in agricultural areas although opposition is high in both groups (Table 7.24).

c) On-line respondents are less in favour of multi-service corridors (Table 7.25).

Regarding all other issues, there are no statistically significant differences or what appear to be strong tendencies to difference between combined on-line and opinionated control respondents.

The 500 KV on-line and 230 KV on-line groups were compared to their respective controls. Patterns of similarities and differences were consistent with the combined comparisons discussed above. An exception is that the 230 KV on-line group is statistically significantly different (at the 0.048 level) from its control in being more concerned over possible health effects.

Summary Comparison - 500 KV and 230 KV Study Areas

Comparisons were made between the two on-line groups and between the two control groups to determine the extent to which the age, voltage and physical size of the corridor relate to perception and attitude formation. No statistically significant differences were found in either comparison. There were, however, some differences in trends of opinion between the 500 KV on-line and 230 KV on-line groups. Results suggest the following:

a) The 230 KV on-line residents tend more to view the line negatively in their general perception of their area (significant at the 0.1626 level) (Table 7.1).

b) The 230 KV on-line group appears more concerned over possible health effects (significant at the 0.1176 level) (Table 7.15).

c) The 230 KV on-line group appears to be more strongly opposed to the construction of new lines in agricultural areas (significant at the 0.1333 level) (Table 7.24).

It is interesting to note that these seemingly stronger and more negative opinions are held by residents on an older line of lower voltage and smaller physical corridor size.

Conclusions

This study grew from a project that drew a number of conclusions regarding the perceptions and attitudes of rural residents directly affected by a transmission line as compared to a group of individuals less directly affected. The conclusions of that study were summarized in the following statement:

> "There appears to be an inverse relationship between the degree of perceived effect that a hydro corridor would have on the public and the current proximity of such a responding public to the facility in question. Control respondents seem to respond more strongly and more negatively towards the idea of a hydro corridor than those respondents who are already (supposedly) affected by an existing corridor."
>
> (Mitchell, 1976)

The results of the current research do not support this statement as an accurate generalization for the study area in question. Based on a more extensive study over a larger area, it is suggested that the differences between on-line and control residents are not as marked as the previous study would indicate.

The previous study found control respondents to be consistently more negative in their attitudes and opinions. While the current study found the control group to be somewhat more negative on some issues, evidence of inconsistency was also uncovered. Because of the ambivalence exhibited, a generalization regarding the negativity of the attitudes of the control group cannot be supported.

The finding of consistently stronger attitudes among control respondents also cannot be supported by the research results. The high proportion of 'do not know' and 'no opinion' responses in the control and apparent inconsistencies

preclude a generalization of greater attitude strength. Among the control stating definite opinions, attitudes expressed were sometimes stronger but the tendency was not sufficiently pervasive to allow its acceptance as a generalization.

Proximity to the transmission corridor was identified as a primary factor influencing attitudes in the previous study. Based on the high proportion of 'do not know' and 'no opinion' responses and seeming inconsistencies in patterns of control response found in this study, it is suggested that direct personal experience rather than proximity is the stronger cognitive component in perception and attitude formation.

Direct personal experience must also be considered in assessing the responses of on-line residents. The attitudes of on-line residents were not generally strongly negative and there was substantial evidence of adjustment and adaptation in their responses. Elements of adaptation were found in responses to questions dealing with opinion of construction, the effect of the line on land use and farming efficiency and the prominence of the corridor in the landscape. It is suggested, therefore, that while a corridor may elicit strong negative reaction in its initial stages, in the years following, consciousness of its impacts diminishes. In the longer term, the line becomes accepted as a neutral component of the landscape. This conclusion is in agreement with the previous study which also found evidence of adjustment by residents on a hydro line that had been in place for about twenty years. Since the first 500 KV line was constructed in 1971 and the parallel line in 1973 and similar adjustment is seen, this study would indicate that the adjustment and adaptation process may occur in as few as five years.

Although this research project indicates that individuals adjust to the presence of a hydro line, it cannot be concluded that transmission corridors do not have continuing social and economic impacts. Some of the impacts remain in the longer term even though adjustment is made to them. There appear to be four main areas of continuing social impact.

The strongest of the impacts appears to be the effect of the presence of the transmission corridor on the market value of affected properties. The analysis of real estate transactions (Chapter 4) indicated that transmission corridors do, in fact, depress the market value of property by about 15 to 30% depending on the size and type of property. The majority of the survey respondents perceive this impact of transmission corridors although they were unable to say by what amount they thought that property values had decreased.

The literature and the survey results indicate that hydro towers do have a measurable effect on farming efficiency but that this is an area where adjustment to the impact occurs. Similarly, transmission corridors do have a continuing visual impact as evidenced by the high level of prominence expressed by the respondents but again, adjustment has been made and corridor is viewed as a neutral element in the landscape.

The results would indicate that the health and safety aspects are not a strong social impact among the respondents to the survey. It is suggested, however, that given the current controversy and media coverage of the issue, health and safety could become a more signficant social impact. Until it can be conclusively proven that there are no health effects associated with high voltage transmission lines, health and safety aspects must be considered as a possible social impact.

An objective of this study was to determine voltage and physical size of hydro lines have an influence on their social and economic impacts and the

attitudes of those affected by the lines. The findings of this study indicate that lines of higher voltage and larger physical size do not necessarily have greater impacts. Neither do they generate stronger or more negative attitudes in the residents they affect in the longer term. This conclusion is based on the comparison of a 500 KV and a 230 KV line that have been in place for a number of years. It is suggested, however, that this conclusion might not hold if corridors of still higher voltage and physical size are constructed. This might be particularly true given the current climate of public consciousness on the issue.

In the past when facilities such as highways and electric transmission corridors were planned and constructed in rural areas, they were completed with a minimum of public involvement and protest. These facilities have social and economic impacts but people accepted them and adjusted to them. In more recent years, this situation has changed. The public is no longer willing to accept the installation of facilities without serious review of the proposed project and participation in the decision-making process. Nowhere is this change more apparent than in relation to electric power generating and transmission facilities. Clear evidence of this change is the formation of bodies such as the Royal Commission on Electric Power Planning. In the future, only if the public is involved in every phase of decision-making and the views of the affected public are respected and accommodated, can the acceptance and adjustment as seen in the past, be expected to continue.

Appendix I

Agencies Contacted Regarding Previous Research

Appendix I

Agencies Contacted Regarding Previous Research

Northern States Power Company,
414 Nicollet Mall,
Minneapolis, Minnesota 55401,
Mr. R.O. Jondahl,
Administrator, Real Estate

Niagara Mohawk Power Corporation,
300 Erie Boulevard West,
Syracuse, N.Y. 13202,
Mr. A.B. Cummings, Supervisor,
Right of Way Department

Tennessee Valley Authority,
New Sprankle Building,
Knoxville, Tennessee 37902,
Mr. J. Porter Taylor, Director,
Division of Reservoir Properties

Power Authority of the State of New York,
Office of Land Acquisition,
P.O. Box F,
Grand Gorge, N.Y. 12434,
Mr. R.W. Graves,
Director of Land Acquisition

American Electric Power Service Corp.,
P.O. Box 487,
Canton, Ohio 44701,
Mr. R.H. Walters,
Director of Land Management

Pacific Gas and Electric Company,
77 Beale Street,
San Francisco, California 94106,
Mr. L.E. Grasse,
Supervisor of Land Rights

British Columbia Hydro and Power Authority,
900 - 1045 Howe Street,
Vancouver, B.C.,
Mr. C.W. Nash,
Corporate Services Division

Houston Lighting and Power Company,
Electric Tower,
P.O. Box 1700,
Houston, Texas 77001,
Director of Land Acquisition

Indiana and Michigan Electric Company,
2101 Spy Run Avenue,
Fort Wayne, Indiana 46801,
Director of Land Acquisition

Interstate Power Company,
1000 Main Street,
Dubuque, Iowa 52001,
Mr. Richard Fohrer

Hydro-Quebec,
75 ouest, Boul. Dorchester,
Montreal, Quebec,
M. Laurent Marquis,
Directeur Proprietes

Consumers Power Company,
212 West Michigan Avenue,
Jackson, Michigan 49201,
Mr. W.L. Reid, Manager,
Land & Electric Right-of-Way

Saskatchewan Power Corporation,
Victoria and Scarth Street,
Regina, Saskatchewan,
Mr. M.D. Offet,
Land Superintendent.

Appendix II

Canada Land Inventory Classifications

Appendix II Canada Land Inventory Classifications

Soil Capability for Agriculture

Seven general soil classifications are made through soil survey information. The classifications are based on an intensive, mechanized method of agriculture. While each classification may include several soil types and crops suited, the general capacity is stated.

Class 1 areas have no significant limitations to agricultural practices. The soil is deep, well drained, and fertile and is capable of high productivity.

Class 2 areas have moderate limitations restricting the agricultural productivity of the area. The soil is deep and fertile with good moisture retention.

Class 3 areas have moderately severe limitations to agricultural practices. The productivity is moderate over a limited range of crops with some conservational practices required.

Class 4 areas have severe limitations on agricultural practices. Soil is low to fair in productivity. Only a very narrow range of crops are suitable for these areas.

Class 5 areas have very severe limitations to agricultural production. Soils are not suited to continued growth of sustained crop species. Some improvement practices are feasible in these areas.

Class 6 areas are only suited for the growth of perennial forage crops. Limited grazing practices are possible but improvement practices are impractical.

Class 7 areas are not suited to any agricultural production and have no permanent pasture. Areas of rock and swamp are included in this classification.

Class 0 areas have organic soils which are not classified for agricultural capability.

Land Capability for Forestry

In the Land Capability for Forestry, seven classifications of soil are considered for their capacity to grow commercial timber. The mineral and organic components of the soil structure are determinants as well as subsoil types, moisture, fertility, landforms, and climatic conditions. All conditions for Land Capability for Forestry are considered only under natural conditions without fertilization or drainage.

Class 1 areas have no significant limitations to the growth of good, commercial timber. Soils are deep, fertile and well-drained. The productivity of the area is usually greater than 111 cubic feet per acre per year.

Class 2 areas have slight limitations to commercial forest growth. The soil is deep and of moderate water holding capability. The productivity of these areas is usually 90-110 cubic feet per acre per year.

Class 3 areas have moderate limitations to the production of commercial forests. Soils are of moderate depth and medium textural qualities. Productivity is usually 71-90 cubic feet per acre per year.

Class 4 areas have moderately severe limitations to the growth of commercial forests. The soil is shallow to moderate in depth with coarse to fine texture and generally poor drainage. Productivity is usually 51-70 cubic feet per acre per year.

Class 5 areas have severe limitations to the growth of commercial forests. Soils are shallow and coarse with minimal water holding ability. Productivity is poor at 31-50 cubic feet per acre per year.

Class 6 areas have very severe limitations to the growth of commercial forests. Soil is shallow and stony with minimal fertility. Productivity is usually 11-30 cubic feet per acre per year.

Class 7 areas have extremely limiting conditions for the growth of commercial forests. Bedrock is often exposed and some areas in this classification are of an acid base, disallowing any forest growth. Productivity is less than 10 cubic feet per acre per year.

Land Capability for Recreation

Class 1 areas have an outstanding capability to support one or more outdoor recreation activities on a sustained basis.

Class 2 areas have a high capability to outdoor recreation on an annual basis.

Class 3 areas allow recreation on a non-intensive basis and will yield a moderately high capability for recreation.

Class 4 areas have a moderate capability for recreation and can sustain moderately intensive activities on a dispersed basis.

Class 5 areas have a moderately low capability for outdoor recreation. Dispersed activities must be conducted to ensure sustained capability.

Class 6 areas can maintain low annual outdoor recreation on a dispersed basis. These areas are generally classed as having a low capability for recreation.

Class 7 areas have a very low capability for recreation. Within this classification, open space may be the only characteristic suited to any form of recreation.

Appendix III

Analysis of Physical Characteristics

Appendix III Analysis of Physical Characteristics

Sampling Method

Sampling for the statistical test of physical parameters was carried out using a grid pattern. Sample points were collected at one half mile intervals along either side of the transmission and control corridors. Canada Land Inventory maps were used for soil capability for agriculture, land capability for forestry and land capability for recreation. The map for physiography was from Chapman and Putnam (1966). All maps were at the scale 1:250,000.

Table III-1

Physiography-500 KV Line and East Control

Landform	Sand Plains	Till Plains	Clay Plains	Drumlins	Till Moraines	
Line	40	88	29	6	19	182
Control	28	83	44	11	21	187
	68	171	73	17	40	369

df = 4 x^2 = 7.24

Table III-2

Soil Capability for Agriculture-500 KV Line and East Control

Class	1	2	3	4	5	0	
Line	92	8	11	30	11	8	160
Control	110	5	5	21	15	4	160
	202	13	16	51	26	12	320

df = 5 x^2 = 8.47

Table III-3

Land Capability for Forestry-500 KV Line and East Control

Class	1	2	3	
Line	19	134	38	191
Control	30	120	43	193
	49	254	81	384

df = 2 x^2 = 3.79

Table III-4

Land Capability for Recreation-500 KV Line and East Control

Class	5	6	
Line	91	98	189
Control	94	101	195
	185	199	384

df = 1 x^2 = 0

Table III-5

Physiography-230 KV Line and East Control

Landform	Sand Plains	Till Plains	Till Moraines	Spillways	Kame Moraine	
Line	16	74	22	29	17	158
Control	20	57	17	45	25	164
	36	131	39	74	42	322

df = 4 x^2 = 7.78

Table III-6

Soil Capability for Agriculture-230 KV Line and East Control

Class	1	2	3	4+5	6	7+0	
Line	47	29	26	4	29	25	160
Control	58	22	28	1	19	26	154
	105	51	54	5	48	51	314

df = 5 x^2 = 6.74

Table III-7

Land Capability for Forestry-230 KV Line and East Control

Class	1	2	3	5	
Line	25	117	15	6	163
Control	32	115	14	7	168
	57	232	29	13	331

df = 3 x^2 = .51

Table III-8

Land Capability for Recreation-230 KV Line and East Control

Class	3+4	5	6	
Line	39	72	50	161
Control	50	77	33	160
	89	149	83	321

df = 2 x^2 = 4.70

Table III-9

Soil Capability for Agriculture-500 KV and 230 KV Study Areas

Class	1	2	3	4+5	6,7+0	
500 KV	202	13	15	76	13	319
230 KV	106	52	54	5	100	317
	308	65	69	81	113	636

df = 4 x^2 = 205.7

Table III-10

Land Capability for Forestry-500 KV and 230 KV Study Areas

Class	1	2	3+5	
500 KV	50	255	80	385
230 KV	56	233	42	331
	106	488	122	716

df = 2 x^2 = 9.68

Table III-11

Land Capability for Recreation-500 KV and 230 KV Study Areas

Class	3,4+5	6	
500 KV	186	199	385
230 KV	239	83	322
	425	282	707

df = 1 x^2 = 52.5

Appendix IV

Real Estate Transaction Data

Appendix IV

Real Estate Transaction Data

Table IV-1

Summary of Sales - Frequency and Average Price Per Acre
500 KV Line

Size Category	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Totals
1 0.1-0.9A	2 26979	7 14324	11 32634	3 30966	--	10 24867	4 23429	2 34140	--	6 103,642	7 130,358	52 50211
2 1.0-4.9A	--	2 7656	4 3739	2 1100	1 8000	4 9019	6 9095	2 21248	2 18250	2 4031	--	25 8487
3 5.0-9.9A	--	3 1400	1 400	2 464	3 2250	1 3125	2 1891	1 8333	3 2937	1 9375	2 6723	19 3116
4 10.0-49.9A	13 744	52 754	22 953	11 793	10 1254	9 1835	12 1390	8 2149	7 3738	5 3921	4 4437	158 1340
5 50.0-99.9A	1 543	8 319	5 484	5 886	3 314	4 453	7 921	2 1121	1 660	2 1842	--	38 681
6 100+A	3 326	4 380	6 475	--	--	1 316	2 1391	1 2300	--	--	2 1056	19 677
Totals	19 3429	76 2146	49 8175	23 7350	17 1660	29 10570	33 5393	16 8803	13 5092	16 41411	15 63054	306

Real Estate Transaction Data

Table IV-2

Summary of Sales - Frequency and Average Price Per Acre
500 KV Control

Size Category	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Totals
1	2	7	4	5	5	8	19	15	9	8	4	86
0.1-0.9A	13095	28017	59899	35060	35825	16298	28866	100047	134694	87957	102934	61950
2	3	3	3	6	6	8	7	2	1	3	9	51
1.0-4.9A	15979	7794	7044	4898	7892	11398	9345	6225	33076	23629	20565	12299
3	1				1		1	1				4
5.0-9.9A	2266				1466		3200	2300				2358
4	8	21	6	4	6	3	27	13	7	3	4	104
10.0-49.9A	989	614	647	618	1262	662	1878	2478	2951	6709	4163	1832
5	2	6	5	7	3	2	4	7	2	4	2	44
50.0-99.9A	179	808	452	566	240	2785	645	1619	801	1043	882	890
6	2	1	7	2	2	5	2	3	2			26
100.0+A	465	400	670	2448	617	722	657	1273	825			867
Totals	18	38	25	24	23	26	60	41	21	20	19	315
	4755	6364	10862	9001	10325	8951	11194	38123	60439	40613	32381	

Real Estate Transaction Data

Table IV-3

Summary of Sales - Frequency and Average Price Per Acre
230 KV Line

Size Category	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Totals
1 0.1-0.9A	3 11863	1 3000	2 24786	8 17210	3 49719	1 578	3 31458	2 39850	0	1 79045	2 129683	26 34156
2 1.0-4.9A	3 5547	2 697	2 2625	0	2	2 3176	3 5742	1 7571	2 20007	1 27500	1 13181	19 7237
3 5.0-9.9A	1 1685	0	2 1410	3 1702	0	2 1210	2 3228	2 3868	1 4364	2 5329	0	16 2828
4 10.0-49.9A	7 918	16 446	8 1275	1 230	6 687	16 1083	12 1193	6 2040	5 2276	6 2334	2 3835	85 1236
5 50.0-99.9A	0	4 487	2 314	0	2 413	3 1000	2 582	3 426	1 736	0	1 2191	18 654
6 100.0+A	2 394	4 400	3 328	4 447	4 584	4 456	2 773	2 1088	1 1750	3 6044	1 1340	30 1142
Totals	16 3820	27 558	19 3655	16 9050	17 9342	28 1125	24 5628	16 6919	10 5824	13 11488	7 96113	194

Real Estate Transaction Data

Table IV-4

Summary of Sales - Frequency and Average Price Per Acre
230 KV Control

Size Category	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Totals
1	2	4	4	4	2	10	4	2	4	2	3	42
0.1-0.9A	10424	26202	37745	16856	5370	14741	50472	86150	65083	107000	105188	39676
2	2	5	4	5	0	1	1	3	2	1	2	26
1.0-4.9A	3100	10924	8388	2466		2400	1625	8416	15000	12333	32206	10443
3	2	0	0	1	1	2	2	1	2	0	0	11
5.0-9.9A	2100			955	2433	4293	1837	946	1994			2253
4	5	13	10	3	6	6	14	5	5	2	0	69
10.0-49.9A	460	609	663	1633	984	1203	2646	3777	4146	2259		1682
5	2	4	0	1	4	2	1	2	1	0	3	21
50.0-99.9A	289	413		120	1401	554	1296	994	2100		1461	909
6	1	2	1	1	2	2	5	5	1	3	0	23
100.0+A	70	445	750	1130	1365	933	2850	1133	1335	925		1366
Totals	15	28	19	15	15	24	27	18	15	8	8	192
	2297	6067	10101	5789	1827	7029	9621	12501	21232	27661	48044	

Table IV-5

Summary - Real Estate Analysis
Chi-Square Levels of Significance

	500 KV Line x 500 Control	230 KV Line x 230 Control	500 KV Line x 230 KV Line
Frequency by Size Table 4.2	0.001*	0.2	0.02*
Frequency by Year Table 4.3	0.001*	0.9	0.05*
Table 4.4	0.01*	--	--
1968-69 Sales by Size Table 4.5	0.1	--	--

Note: See Appendix VI for explanation of Chi-Squared Tests and Significance Levels.

Appendix V

Sample Questionnaires

Appendix V Sample Questionnaire

Transmission Line Questionnaire

PART A

1. a) Which of the following best describes your type of property?

Farm _____ Commercial _____

Residential _____ Other _____

b) If a farm, type of operation _____

2. Size of property _____ Acres

3. Are you the owner/tenant of the property?

owner _____ tenant _____

4. What percentage of your acreage is farmed?

0-24% _____ 25-49% _____ 50-74% _____ 75-100% _____

5. If the land is farmed, by whom?

by owner _____ by tenant _____ by both _____

PART B

1. What do you like about living in this area?

_____

2. Are there things about this area you dislike?

_____

PART C

1. How many high-voltage transmission towers are located on your property?

_____ towers

2. Where are the towers located? (check more than one if necessary)

along a fence line _____ a field _____

woodlot _____ close to buildings _____

NOTE: Original questionnaire allowed additional space for comments.

PART C (cont'd)

3. On the page provided at the end of this questionnaire could you please draw a rough sketch of your property showing boundaries, buildings, hydro towers and other prominent features.

4. Does the hydro line affect your life in any way.

   yes _____ no _____

   Please comment: _____

PART D

1. How long have you lived here? _____ years

2. Did you live on this property prior to the construction of the hydro line?

   yes _____ no _____

   IF YES answer the following

   a) What was your general opinion at the time of construction?

   very favourable _____ opposed _____

   favourable _____ very opposed _____

   neutral _____ no opinion _____

   Why? _____

   500 KV Line Only:

   b) What was your opinion of the construction of the second parallel line?

   very favourable _____ opposed _____

   favourable _____ very opposed _____

   neutral _____ no opinion _____

   Why? _____

   IF NO

   a) When you bought the property was the presence of the hydro line in your decision?

   strong consideration _____ little consideration _____

   consideration _____ no consideration _____

   neutral _____ no opinion _____

   Comment: _____

PART D (cont'd)

3. Have you ever considered selling your property because of the hydro line?

yes _____ no _____

Comment: _____

4. a) What type of arrangement with Hydro covers this property?

Easement rights _____ Full title _____ Do not know _____

Payment was made Lump sum _____

annual payment _____

b) How satisfied are you with this arrangement?

very satisfied _____ not satisfied _____

satisfied _____ very unsatisfied _____

neutral _____ no opinion _____

Comment: _____

5. Do you feel the Hydro line affects the value of this property?

yes _____ no _____ no opinion _____

If yes, has the value

increased _____ decreased _____

By what amount? _____(%)

Why? _____

PART E

1. What is the land use(s) around the base of the tower(s)?

_____

2. Have the tower(s) affected your farming efficiency?

yes _____ no _____ do not know _____

If yes, please comment: _____

3. Would you do anything different with the land if the line wasn't there?

yes _____ no _____ do not know _____

Please comment: _____

PART F

1. In recent years a number of studies have been done concerning the possible health effects of high voltage transmission lines. Most of the studies were inconclusive. Are you aware of any controversy?

   yes _____ no _____

   Are you concerned about the possible effects?

   very concerned _____ not very concerned _____

   concerned _____ not concerned at all _____

   neutral _____ no opinion _____

   Please comment: _____

2. Have you had any accidents on your property that were related to the hydro line?

   yes _____ no _____

   If yes, please give a short description: _____

3. Have you been to Hydro's safety demonstration at Essa?

   yes _____ no _____ no but heard of it _____

   Comments: _____

PART G

1. Landscape features assume different prominence in peoples' minds. (You can't see the forest for the trees!) What position does the hydro line assume in yours?

   very prominent _____ not prominent _____

   prominent _____ not prominent at all _____

   neutral _____ no opinion _____

2. Does the appearance of the hydro line bother you?

   yes _____ no _____

   Please comment: _____

PART G (cont'd)

3. a) Is the line on your property a 230 KV or a 500 KV line?

230 KV _____ 500 KV _____ do not know _____

b) If the voltage carried by the line were different, would any of your opinions be different?

yes _____ no _____ do not know _____

Please comment: _____

c) If the physical size of the line were different, would any of your opinions be different?

yes _____ no _____ do not know _____

Please comment: _____

4. If it were necessary to increase the hydro capacity through this area which of the following would you prefer?

a new corridor _____

another set of towers parallel to present towers _____

taller towers with more lines _____

Comments: _____

5. Which of the following best describes your feeling about the construction of new lines in agricultural areas?

very favourable _____ opposed _____

favourable _____ very opposed _____

neutral _____ no opinion _____

6. It has been suggested that larger corridors of land might be used to carry hydro, natural gas and water supplies. Are you in favour of multi-service corridors?

yes _____ no _____ do not know _____

Please comment: _____

7. Since you have lived here have you had any complaints or personal conflicts with Hydro about the line?

yes _____ no _____

Comments: _____

PART H

1. Sex: F _____ M _____

2. Age: less than 21 _____ 21 - 40 _____

   40 - 60 _____ over 60 _____

3. Position in household: _____

4. Did anyone else participate in filling out this questionnaire?

   _____

5. Education: elementary _____

   secondary _____

   college or university _____

   vocational _____

6. What do you consider to be your main occupation?

   _____

7. Are you a year-round resident of the area?

   yes _____ no _____

8. How long has the property been in the family?

   _____

9. Do you have any further comments?

   _____

NOTE: If you would be interested in receiving information about the results of this study please fill in the space below

Name: _____

Address: _____

_____

_____

THANK YOU!

Control Questionnaire

PART A

1. a) Which of the following best describes your type of property?

   Farm _____ Commercial _____

   Residential _____ Other _____

   b) If a farm, type of operation _____

2. Size of property _____ Acres

3. Are you the owner/tenant of the property?

   owner _____ tenant _____

4. What percentage of your acreage is farmed?

   0-24% _____ 25-49% _____ 50-74% _____ 75-100% _____

5. If the land is farmed, by whom?

   by owner _____ by tenant _____ by both _____

PART B

1. What do you like about living in this area?

   _____

2. Are there things about this area you dislike?

   _____

PART C

Could you please answer the following questions with reference to the hydro line property and people located to the west of your area.

1. On the page provided at the end of this questionnaire could you please draw a sketch of your area indicating concession roads, your property and the hydro line.

2. Does the hydro line affect their life in any way?

   yes _____ no _____ do not know _____

   Please comment: _____

PART D

1. How long have you lived here? _____ years

2. Did you live on this area prior to the construction of the Hydro line?

   yes _____ no _____

   IF YES answer the following

   a) What was your general opinion at the time of construction?

   very favourable _____ opposed _____

   favourable _____ very opposed _____

   neutral _____ no opinion _____

   Why? _____

   b) What was the general opinion of the people on the line at the time of construction?

   very favourable _____ opposed _____

   favourable _____ very opposed _____

   neutral _____ no opinion _____

   do not know _____

   Why? _____

   500 KV Control only:

   c) What was the general opinion of the people on the line at the time of construction of the second parallel line?

   very favourable _____ opposed _____

   favourable _____ very opposed _____

   neutral _____ no opinion _____

   do not know _____

   Why? _____

PART D (cont'd)

3. Would the presence of a hydro line be a consideration in your decision to purchase property?

strong consideration _____ little consideration _____

consideration _____ no consideration _____

neutral _____

Comment: _____

4. Are the people on the line satisfied with their land dealings with Hydro?

very satisfied _____ not satisfied _____

satisfied _____ very unsatisfied _____

neutral _____ no opinion _____

do not know _____

Comment: _____

5. Does the hydro line affect the value of their property?

yes _____ no _____ do not know _____

If yes, has the value

increased _____ decreased _____

By what amount _____ (%)

Why? _____

PART E

1. Do the hydro towers affect their farm efficiency?

yes _____ no _____ do not know _____

If yes, please comment: _____

2. Might they do anything different with the land if the line wasn't there?

yes _____ no _____ do not know _____

Please comment: _____

PART F

1. In recent years a number of studies have been done concerning the possible health effects of high voltage transmission lines. Most of the studies were inconclusive. Are you aware of any controversy?

   yes _____ no _____

   How concerned are the people on the line about the possible effects?

   very concerned _____ not very concerned _____

   concerned _____ not concerned at all _____

   neutral _____ no opinion _____

   do not know _____

   Please comment: _____

2. Are you aware of any accidents that were indirectly related to hydro lines?

   yes _____ no _____

   If yes, please comment: _____

3. Have you been to Hydro's safety demonstration at Essa?

   yes _____ no _____ no but heard of it _____

   Comments: _____

PART G

1. a) Landscape features assume different prominence in peoples' minds (You can't see the forest for the trees!) What position does the hydro line assume in <u>your</u> mind?

   very prominent _____ not prominent _____

   prominent _____ not prominent at all _____

   neutral _____ no opinion _____

   b) What is the position in the minds of the people on the line?

   very prominent _____ not prominent _____

   prominent _____ not prominent at all _____

   neutral _____ no opinion _____

   Comment: _____

PART G (cont'd)

2. Does the appearance of the hydro line bother you?

yes _____ no _____

Please comment: _____

3. a) Is the line to the west of your property a 230 KV or a 500 KV line?

230 KV _____ 500 KV _____ do not know _____

b) If the voltage carried by the line were different, would any of their opinions be different?

yes _____ no _____ do not know _____

Please comment: _____

c) If the physical size of the line were different, would any of their opinions be different?

yes _____ no _____ do not know _____

Please comment: _____

4. If it were necessary to increase the hydro capacity through this area, which of the following would they prefer?

a new corridor _____

another set of towers parallel to present towers _____

taller towers with more lines _____

Comments: _____

5. Which of the following best describes your feeling about the construction of new lines in agricultural areas?

very favourable _____ opposed _____

favourable _____ very opposed _____

neutral _____ no opinion _____

6. It has been suggested that larger corridors of land might be used to carry hydro, natural gas and water supplies. Are you in favour of multi-service corridors?

yes _____ no _____ do not know _____

Please comment: _____

PART H

1. Sex: F _____ M _____

2. Age: less than 21 _____ 21 - 40 _____

   40 - 60 _____ over 60 _____

3. Position in household: _____

4. Did anyone else participate in filling out this questionnaire?

   _____

5. Education: elementary _____

   secondary _____

   college or university _____

   vocational _____

6. What do you consider to be your main occupation?

   _____

7. Are you a year-round resident of the area?

   yes _____ no _____

8. How long has the property been in the family?

   _____

9. Do you have any further comments?

   _____

NOTE: If you would be interested in receiving information about the results of this study please fill in the space below

Name: _____

Address: _____

_____

_____

THANK YOU!

Appendix VI

Community Profile

Appendix VI

Chi-Squared Tests and Levels of Significance

The chi-squared statistical test is a measure of association or a test of statistical significance. A measure of association indicates whether two variables or factors are systematically related. Measures of association also have predictive value by indicating whether knowledge of a case's value on one variable better enables one to predict a case's value on another variable.

To determine whether a systematic relationship exists using the chi-squared test, the actual frequencies in cells of contingency tables are compared with the frequencies that would be expected if no systematic realtionship existed, as based on row and column totals. The formula for chi-squared is as follows:

$$X^2 = \sum \frac{(f_o^i - f_e^i)^2}{f_e^i}$$

where f_o^i equals the observed frequency and f_e^i is the expected frequency.

In general, a large chi-squared value (i.e. a large difference between observed and expected frequencies) implies that a systematic relationship exists between the variables. The size of the chi-squared value, however, is influenced by the size of the sample and the number of rows and columns in the contingency table - the degrees of freedom. To determine whether there is a relationship between the variables it is necessary to determine the probability of obtaining a chi-square as large or larger than the one in the sample by chance if the variables were not related. These probabilities or significance levels are usually determined by comparing the calculated chi-squared value with standard tables of chi-squared values at different significance levels and degrees of freedom. The computer statistical package used in this study however, gives significance levels as exact probabilities.

In interpreting the results of chi-square tests significance levels are very important. Generally, the smaller the value of the significance level the more likely that there is a relationship between the variables. For example, a significance level of 0.001, indicates that the chances are only 1 in 1,000 that the frequencies observed arise purely by chance and not because the variables are related. In other words there is a 99.9% chance that a relationship exists. Similarly, a significance level of 0.01 indicates a 1 in 100 probability and a significance level of 0.5 a probability of 1 in 2 that the value arose by chance in the sample. Although consideration must be given for the situation under analysis and the size of the samples, generally significance levels of less than 0.1 (90%) are considered to show the existance of a relationship. Such situations are usually called "statistically significant". There may, however, be other situations where there is an apparent relationship but where the chi-squared value and its associated significance level do not warrent a designation of "statistically significant". These situations may be called simply "significant" or noted as interesting.

Appendix VI

Community Profile

Appendix Table V-1

Summary - Property and Socio-Economic Aspects
Chi-Squared Levels of Significance

Variable	Comb Lind x Comb Control	500L x 500C	230L x 230C	500L x 230L	500C x 230C
Property Type Table 6.1	0.0065*	0.5724	0.0001*	0.0435*	0.0150*
Type of Farm Table 6.2	0.0777*	0.1927	0.1937	0.4006	0.7685
Acreage Table 6.3	0.0074*	0.5347	0.0005*	0.2604	0.0199*
% Farmed Table 6.4	0.0266*	0.7329	0.0007*	0.1703	0.0165*
Sex Table 6.6	0.1454	0.5525	0.3010	0.6963	0.9801
Age Table 6.7	0.1174	0.1346	0.3412	0.7317	0.5327
Education Table 6.8	0.1338	0.3273	0.2901	0.8061	0.4573
Occupation Table 6.9	0.0617*	0.8957	0.0080*	0.0354*	0.8363
Years Residence Table 6.10	0.3616	0.6180	0.5355	0.7158	0.4093

* denotes statistically significant differences

Appendix VII

Analysis of Social Impacts

Appendix VII

Analysis of Social Impacts

Table VII-1

Summary - Social Impacts
Chi-Square Levels of Significance

	Comb. Line x Comb. Control	500L x 500C	230L x 230C	500L x 230L	500C x 230C
Negative Factor Table 7.1	0.1180	0.5601	0.0370	0.1626	0.8798
Affects Life Table 7.2	0.2	0.8	0.05*	0.2336	0.6448
Opinion of Construction Table 7.4	0.1466	0.3531	0.1546	0.2835	0.5000
Opinion of Construction 2nd Line Table 7.6	0.4496	0.4496	--	--	--
Factor in Buying Table 7.7	0.0468*	0.2353	0.1830	0.4115	0.3304
Property Value Affected Table 7.9	0.7984	0.7885	0.9404	0.4049	0.1824
Settlement Satisfaction Table 7.10	0.6098	0.7577	0.3478	0.4422	0.6295
Efficiency Affected Table 7.12	0.0001*	0.0179*	0.0053*	0.9562	0.4113
Use Land Differently Table 7.13	0.9625	0.9191	0.6925	0.7626	0
Aware Health Effects Table 7.14	0.9433	0.7240	0.3935	0.1296	0.7788
Concern-Health Table 7.15	0.2423	0.2273	0.0486*	0.1176	0.4830
Accidents Table 7.16	0.6034	0.3915	0.8374	0.9307	0.2985
Prominence-Your Opinion Table 7.17	0.0290*	0.1258	0.1159	0.4423	0.4545
Appearance Table 7.19	0.5820	0.5306	0.9447	0.5148	0.9093
KV Different Table 7.20	1.000	0.6640	0.4453	0.5936	0.7333
Size Different Table 7.22	0.5023	0.3783	0.4502	0.9097	1.0000
New Line Type Table 7.23	0.0965*	0.3145	0.2519	0.3131	0.6880
Lines in Agr. Area Table 7.24	0.1873	0.6513	0.2126	0.1333	0.8026
Multi-Use Corridor Table 7.25	0.0055*	0.1598	0.0336*	0.9509	0.6606

* indicates statistically significant difference

Table VII-2

Summary - Farmer-Rural Resident Comparison
Chi-Square Levels of Significance

	All Groups Farmer x Non-Farmer	Comb. Line Farmer x Non-Farmer	Comb. Control Farmer x Non-Farmer
Negative Factor	0.2621	0.2055	0.9506
Affects Life	0.1000	0.2445	0.7979
Opinion of Construction	0.4844	0.8761	0.0855
Opinion of Construction - 2nd Line	0.9384	0.7765	0.1353
Factor in Buying	0.1463	0.4871	0.3243
Factor in Selling	--	0.1954	--
Settlement Satisfaction	0.5809	0.1727	0.5979
Property Value Affected	0.8106	0.6959	0.6382
Efficiency Affected	0.8946	0.8949	0.5570
Use Land Differently	0.0947*	0.1101	0.3249
Aware Health Effects	0.5037	0.5467	0.9001
Concern Health	0.8248	0.8432	0.1568
Accidents	0.8635	0.9687	0.6931
Prominence-Your Opinion	0.8184	0.3017	0.5527
Appearance	0.1680	0.8124	0.0799*
KV Different	0.5774	0.8085	0.6044
Size Different	0.8447	0.8747	0.7222
New Line Type	0.4332	0.3148	0.9991
Lines in Agr. Areas	0.0855*	0.0804*	0.5841
Multi-Use Corridors	0.0666*	0.4432	0.9438

* indicates statistically significant difference

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